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CERTIFICATION REFERENCE FOR THE MARK

HEAT PUMPS

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AFNOR Certification identification No.: NF- 414

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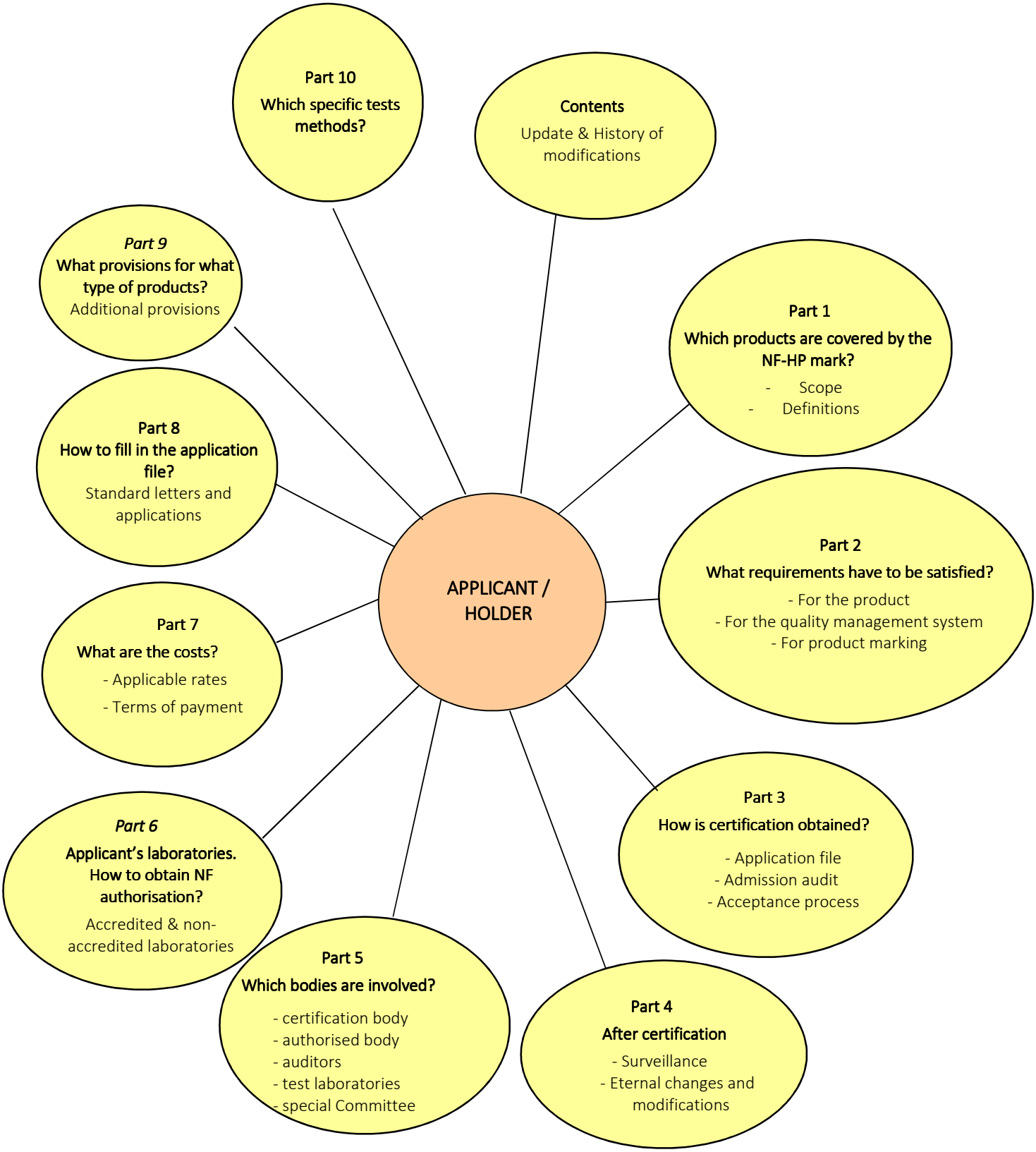
CONTENTS



This version of the certification standard was approved by the President of AFNOR Certification on September 10, 2014.

This standard, in accordance with the French Consumer Code, includes:

- the General Rules for the NF mark setting out the general organisation and terms of use of the mark,
- these certification rules describing the technical specifications to be applied (standards and additional specifications, if applicable) and the procedure for checking compliance with these specifications.

It cancels and replaces any previous versions.

Along with the holders', users' and technical experts' representatives, EUROVENT CERTITA undertakes to ensure the relevance of this standard, in terms of the certification process and of the definitions of requirements as regards market trends.

The certification rules may be revised, partially or in full, by EUROVENT CERTITA and in all cases after consultation with the involved parties.

HISTORY OF MODIFICATIONS

Modified part	Revision no.	Date of application	Modification carried out
-	0	01/06/2007	Creation of application of NF mark
Whole document	1	20/03/2009	Global reference standard revision
Whole document	2	15/06/2010	Adaptation of the Standard: • to swimming pool heat pumps, • certification up to 100 kW, • manufacturing unit monitoring procedure, • test bodies, • Sound level threshold.
2	3	01/04/2011	Addition of a new temperature condition 22_25°C
Whole document	4	31/01/2012	Integration of provisions of 2012 thermal regulations (RT 2012). Extension to reversible heat pumps (with chilling function). Change of NF logo Document revision to permit better readability with: Creation of appendices per product category (part 9): • Appendix A: Electric HPs • Appendix B: Swimming pool HPs and appendices for special test methods (part 10) • Appendix AA: Acoustic tests (restatement of 10.2) • Appendix BB: Ground – ground HP tests (restatement of 10.3.3) • Appendix CC: Water – ground HP tests (restatement of 10.4.2) • Appendix DD: Outdoor air – ground HP tests (restatement of 10.4.3)
Whole document	5	20/08/2012	Extension of scope to dual-mode heat pumps and gas absorption and engine-driven gas heat pumps: • Part 9, Appendix C: specifications for dual-mode HPs, • Part 9, Appendix D: specifications for gas absorption HPs, • Part 9, Appendix E: specifications for engine-driven gas HPs, • Part 10, Appendix EE: Test methods for gas HPs. Transfer of type 2 data sheets to technical specification appendices. Addition of test laboratory (AIT) for thermal testing (§ 5.3). Addition of seat for manufacturer panel on committee (§ 5.5). Edited details.
Whole document	6	23/10/2012	Appendix D, § D.4.1.1 : Modification of the downstream temperatures on RT 2012 matrix
Whole document	7	30/06/2014	Quality: integration of provisions to meet requirements of the standard NF EN ISO/CEI 17065 following the documents AFNOR CERTI A 02230v4
			Editorial: Update of the trading name of the certified body and the mark
Annex C			Technical: Adding of simulation of performances of dual-mode heat pumps.
Body of the document	8	18/09/2014	Editorial: reorganisation of paragraphs (adding of the introduction), slight simplification of some paragraphs for a better readability. Processes redrawn. Part 6 renumbered and partially reformulated. Part 8 simplified (certification file in one hard copy)
Annex A			Technical: adding of seasonal performances for HP on heating mode, optional

INTRODUCTION

The NF mark, property of AFNOR, created in 1938, is a voluntary label which complies with French, European and international standards.

The current reputation of the NF mark is the result of a constant pursuit of excellence and a will to meet the changing expectations of the markets: national, European and global markets.

AFNOR Certification and EUROVENT CERTITA, impartial certification bodies, bring you its technical expertise in terms of certification: which means products evaluation and verification the organisation the quality control management of the NF mark holders.

AFNOR owns the NF mark and granted AFNOR Certification the exclusive operating licence.

AFNOR Certification manages and runs NF certification system, which defines the NF mark governance rules and the procedures. AFNOR Certification ensures that all stakeholders fulfil their mission correctly regarding each of their respective responsibilities and attributions.

The NF Mark is a collective mark of certification filed with General Rules which set the general organisation and the NF mark using conditions.

The NF “Heat Pump” certification rules are composed of the General Rules of the NF Mark, of this certification rules and standards – which are listed, also as potential additional features.

This certification rules comes under the regulatory framework for certification of services and products other than agricultural, forest, food or sea, provided for in articles L-115-27 to L 115-33 and R 115-1 to R 115-3 of the Consumer Code, taking account of the opinion of the “Conseil national de la Consommation” (National Consumer Council) dated of December 17, 2007.

The right to use the NF mark is granted on the basis of the conformity of one or several standards and, more generally, of the entire certification rules, for a product coming from an applicant and a given manufacturing and/or conception and/or process.

Applicants/holders and its distributors are each responsible for the right to use the mark regarding the product concerned.

The applicant/holder shall implement all necessary means to guarantee permanently the product conformity to this certification rules, even its potential evolution.

Part 1
Scope

1.1 SCOPE

These certification rules cover heat pumps with heating capacity less than or equal to 100 kW. However, for the case where the same product is able to work with either glycol water/water or water/water, the 100 kW limit capacity is applicable to the lowest power.

The products covered by the certification are heat pumps (HP) belonging to the following categories:

- electrically driven heat pumps for space heating, including appliances with a cooling functions (see Part 9, Annex A)
- electrically driven heat pumps used for heating swimming pools water for seasonal and/or year-round use, installed outdoors or inside a building (see Part 9, Annex B),
- electrically driven heat pumps covering both above uses,
- dual-mode heat pumps, i.e. designed for space heating and domestic hot water production (see Part 9, Annex C),
- gas absorption heat pumps, including appliances with a cooling function (see Part 9, Annex D),
- engine-driven gas heat pumps, including appliances with a cooling function (see Part 9, Annex E)

In the case of heat pumps with separate components, the assembly thereof is deemed to be an inseparable system to determine the certified characteristics.

1.2 DEFINITIONS

1.2.1 Applicant / Holder

Corporate Body who manages and is responsible for compliance with all of the requirements defined in the certification rules of the NF Mark 414.

Any legal body, designated below, may request a right to use the NF Mark.

- The intellectual property owner of heat pumps,
- The assembler of heat pumps,
- The distributor of heat pumps.

The contractual relationships liable to exist between the applicant/holder and the various suppliers to whom any of the requirements covering the following stages are subcontracted: design, manufacture (with the exception of product components), assembly, tests, marking and packaging, shall be the subject of a contract as specified in Part 8. The latter defines the commitment of the subcontractor(s) to comply with the requirements of the certification rules pertaining to them.

1.2.2 Authorised agent

Corporate body or individual established in the E.E.A who acts as representative of the applicant/holder outside the E.E.A and has a written contractual mandate from the latter meaning that he can act on the applicant's behalf and specifying the applicable context (associated missions and responsibilities and financial aspects, complaints, certifying body contact, amongst others) in the NF mark certification process according to the provisions of the certification standard.

The authorised agent may be the distributor, or the importer; their different functions are clearly identified (see Part 8 of the document).

1.2.3 Distributor

Corporate body distributing the applicant's/holder's products who does not act upon the product to modify its conformity to the NF mark requirements.

The types of distributor may be as follows:

- Distributors who **have no technical intervention** on the product and distribute the product under the **trademark of the holder**, this scenario does not give rise to any particular requirements.
- Distributors **who have no technical intervention** on the product and distribute the product with **a change of trademark**. In this scenario, an application to maintain the right of use must be drawn up, as stipulated in Part 8.
- Distributors who have no technical intervention on the product but request modifications that have no impact on the conformity of the product to the NF mark requirements (change in fairing, additional functions (home automation, etc.), colour, etc.) and distribute it with a **change of trademark.** In this scenario, an application to maintain the right of use must be drawn up, as stipulated in Part 8.

1.3 CERTIFIED PRODUCTS

The list of certified products and the information regarding those are available on the website www.certita.org and www.marque-nf.com. It includes:

- designation of the product
- the present Certification Rules
- identification of the holder
- certified characteristics/performances

Details on certified characteristics/performance by type of heat pumps are given in the annexes, part 9.
EUROVENT CERTITA provides, on request, the information regarding the validity of a given certification

Part 2
QUALITY REQUIREMENTS TO BE COMPLIED WITH

2.1 REGULATIONS

The products covered by this certification rules must comply with the French regulations in force. They are manufactured so as to comply with all of the directives and regulations in force that are applicable to them.

Granting the right to use does not, by any mean, replace the responsibility of EUROVENT CERTITA that legally falls to the holder company which owes the right to use the NF mark.

2.2 STANDARD AND ADDITIONAL SPECIFICATIONS

2.2.1 Standards concerning the quality management system

NF EN ISO 9001:2008, Quality management systems - Requirements.

NF EN ISO/IEC 17025:2005, General requirements for the competence of testing and calibration laboratories

2.2.2 Additional specifications

Additional specification for each product or covered by the scope of this certification rules are given in part 9.

2.2.3 Specific tests methods

Standards regarding specific tests methods are given in part 10.

2.3 QUALITY MANAGEMENT PROVISIONS

2.3.1 Object

This paragraph, which constitutes the audit reference standards, set the minimum provisions the manufacturer shall implement in terms of quality management so that the products covered by the NF mark are always manufactured in compliance with this certification rules.

The quality system is partly based on the manufacturer setting up series of organisational provisions to control the compliance of the products delivered with the standards and additional specifications, where applicable.

This provisions are described in paragraphs 2.3.2 and 2.3.3 and can be completed with specific requirements related to the type of product certified (Part 9).

2.3.2 Requirement regarding the quality management

The holder must have implemented by his own means, the presence and the efficiency of which are assessed using the applicable requirements of standard NF EN ISO 9001 (in force), in accordance with the following table.

Audits may be reduced for companies with a certified quality management system complying with the standard NF EN ISO 9001 (in force), provided that the ISO certificate sent to EUROVENT CERTITA:

Includes, within its scope and perimeter, sites and activities covered by the NF mark,

Has been issued by an authorised certification body by COFRAC or an EA member (European cooperation for Accreditation) – see members on the COFRAC website (www.cofrac.fr).

During the audit, the auditor is entitled to consult the quality management system audit reports of the ISO certifying body.

In all cases, the reduction may be evaluated again if the conditions for its authorisation are no longer met.

§	TITLE	Quality organisation requirements
4	**Quality management system**	
4.1 a) to e).	General requirements	Identify the processes associated with product manufacture, their interactions, provide resources, control and monitoring.
4.2	**Documentation requirements**	
4.2.1	General	The documentation must include a quality policy, a manual, several procedures, process description and records. Comment: The scope of the documentation can differ depending on the size of the company, the complexity of the processes described and the competence of people.
4.2.2	Quality Manual	
4.2.3	Document control	The NF mark application files must be managed and controlled. Should the product be modified, the managing body should receive information thereof. The standards and this certification standard must be managed.
4.2.4	Records	Records (in paper and/or digital format) must be kept for: - A minimum of 10 years: for product files; to comply with the requirements of European (CE marking) and regulatory directives. - A minimum of 5 years: for all records of product inspections. From receipt to storage, as well as customer complaints.
5	**Management responsibility**	
5.1	Management commitment	Communicate the importance of meeting customer requirements, establish a quality policy, draw up quality objectives, management reviews, resources.
5.3	Quality policy	Applicable in full
5.4.1	Planning objectives	Applicable in full
5.5	**Responsibility, authority and communication**	
5.5.1	Responsibility and authority	Applicable in full
5.5.2	Management Representative	Applicable in full
5.5.3	Internal communication	Applicable in full
5.6	**Management review**	
5.6.1	General	Management must, at planned intervals, review all of the requirements linked to the NF mark.

6	**Resource management**	
6.1	Provision of resources	Applicable in full
6.2	**Human resources**	
6.2.1	General	Applicable in full
6.2.2	Competence, awareness and training	Applicable in full
6.3	Infrastructure	Provide and maintain the buildings, equipment and supporting services needed to ensure product conformity.
7	**Product manufacture**	
7.1	Planning of product manufacture	The requirements of this standard must be taken into account.
7.2.3	Communication with customers	Applicable in full
7.4	**Purchasing**	The body must set up and implement inspections or other activities required to ensure that the purchased product meets the specified purchasing requirements.
7.5	**Production and preparation of service**	
7.5.1	Control of service preparation and production	Comment: Service = product
7.5.2	Validation of production processes and service preparation	The processes associated with product manufacture
7.5.3	Identification and traceability	Applicable in full
7.5.5	Product preservation	Applicable in full
7.6	**Control of monitoring and measuring equipment**	Applicable in full
8.2	**Monitoring and measurement**	
8.2.2	Internal audit	The audit must cover at least compliance with the requirements of this standard.
8.2.4	Product monitoring and measurement	Applicable in full
8.3	**Control of nonconforming product**	Applicable in full For nonconforming products, the NF mark must be withdrawn.
8.4	**Data analysis**	Restricted to paragraphs b and d.
8.5	**Improvement**	
8.5.2	Corrective action	Applicable in full Additional requirement for the NF mark: Records of complaints regarding certified products and their processing must be made and kept.
8.5.3	Preventive action	Applicable in full

2.3.3 Requirement specific to products

General

The manufacturer must have the necessary resources and means during the inspections and tests to guarantee products conformity.

The manufacturer must set up a documented inspection plan that must, as a minimum, include the inspections and tests described in the following paragraphs and the complementary requirements defined in part 9.

The inspection results must be recorded in registers or other documents kept for this purpose and retained in accordance with a documented procedure.

This inspections individually defined in the paragraphs below and in part 9 will also have to be documented.

The inspection results must lie within the tolerances defined in the inspection instructions.

2.3.3.1 Control of suppliers and subcontractors

The manufacturer must carry out an incoming goods inspection by sampling or any other evaluation over all the constituent elements involved in the assembly of the heat pumps, in order to ensure their compliance.

2.3.3.2 Inspection during manufacturing

2.3.3.3 Qualification of the brazers/welders

All operators working on all permanent assemblies (such as brazing, welding, gluing, expansion, enlarging…) must be qualified and the manufacturer must be able to prove it.

The manufacturer must be able to trace the product back to the operators who carried out the permanent assembly operations.

2.3.3.4 Leak test (100% inspection)

The manufacturer is obliged to carry out leak tests on its products by any appropriate means. The effectiveness of the device must be proven.

In the event of a defect being observed, the proper operation of all the circuits previously made since the last check must be carefully checked for resumption of tightness.

On the hydraulic circuit

On the refrigeration circuit

The manufacturer must carry out a leak test of the refrigeration circuit at the operating pressure of the heat pump. Several techniques can be used for this test depending on the production conditions. For example, pressurisation with an inert gas (or other similar methods).

The test method used to detect the leaks must have the same sensitivity as the bubble test (described in standard EN 1779). Standard ISO 5149-2 can also be used. The relevance of the method used must be proven by the manufacturer.

2.3.3.5 Load in liquid refrigerant on the factory “packaged unit” (100% inspection)

The methods used to get the vacuum in the refrigeration circuit, before loading the liquid refrigerant, must allow the residual pressure of air to drop and be monitored at less than 10 kPa (10^{-1} bar).

The conditions in which the liquid refrigerant is stored and the amount of liquid refrigerant injected in the refrigeration circuit must be controlled and managed.

In the event of a defect being observed, the proper operation of all the refrigerated circuits previously made since the last check must be carefully checked for reload.

2.3.3.6 Tightness of a refrigeration circuit for installation filled on the site where used (100% inspection)

In the event where the filling is performed at the time of installation, each constituent element of the system must comply with the criteria of 2.3.3.2.2, to guarantee that the components delivered to the fitter are in accordance with the tightness requirements.

Before filling the installation, its global tightness must be checked by the fitter, according to the manufacturer's instructions indicated in a manual supplied with the appliance.

2.3.3.7 Production test for electrical safety, according to NF EN 50106 (100% inspection)

The electrical safety tests must be carried out in accordance with the requirements of standard NF EN 50106 (according to paragraphs 1.1 and 1.2).

2.3.3.8 Inspection on the finished product

2.3.3.9 Tests at the end of assembly line (100%)

Each manufactured product must be put into use at the end of the assembly line to check that it works properly.

2.3.3.10 Inspection of marking

Periodic inspection shall be carried out to ensure the compliance and presence of the marking in the certified product, as defined in §2.4 of this certification rules.

2.3.3.11 Appearance inspection before packaging (100% inspection)

Appearance inspections must be carried out before the product is packaged. All of the inspections and tests carried out throughout the assembly process must be validated and recorded.

2.3.3.12 Availability of spare parts

The manufacturer must draw up a procedure defining the measures to take to guarantee the availability of spare parts for 10 years, once a product is no longer marketed.

Should components be modified, the manufacturer shall assess the impact on manufactured products that have already been delivered and offer replacement solutions that guarantee the performance of the HP. Records must be kept up-to-date and stored.

2.3.3.13 Documentation control

The holder shall check all documents (technical, installation and sales documents, manuals, web sites, etc.) that mention the certified features and the NF logo (as defined in § 2.4 below) before they are circulated. This check shall be validated and recorded by competent, identified persons.

The holder shall also ensure that it controls its applications for the right to use the NF mark, in order to inform EUROVENT CERTITA of any modification of elements forming them, particularly if they affect the certified features.

2.4 MARKING

Marking is an integral part of the certification of a product.

Beyond the identification of a certified product and its traceability, the marking of a product with the NF logo ensures better protection of the mark and facilitates legal proceedings and penalties for infringement.

Furthermore, giving the main certified features is an advantage for consumers and promotes the certification and its content.

2.4.1 Reference texts

The French consumer code: a desire for transparency

Communication of information concerning product and service certification is governed by the regulations. The purpose of this is to make the meaning of labels, certification marks, etc. transparent for consumers and for users.

Accordingly, article R 115-2 of the French Consumer Code stipulates that:

"Where reference is made to certification in advertising, on labelling or the presentation of any product or service, and in commercial documents of any kind relating thereto, the following mandatory information shall be provided to the consumer or user:

- The designation or company name of the certifying body or the collective certification mark,
- The name of the certification standard used,
- The manner in which the certification standard can be consulted or obtained."

General rules of the NF Mark

The purpose of the marking rules given below is to guide the holder in how to meet the regulations and the requirements of the NF mark. The general rules of the NF mark specify the conditions of use, of validity and the penalties in the event of improper use.

The holder shall only use the NF mark in any documents (paper and electronic format) for certified products and only if there is no risk of confusion and interpretation.

When the holder gives copies of certification documents to someone, he has to reproduce it entirely.

2.4.2 The NF logo

The NF logo must ensure identification of every certified product.

The NF certified product must bear a designation and identification distinct from non-certified products.

The holder must only use the NF logo to distinguish certified products, without risk of any possible confusion with other products, particularly with non-certified products.

The NF mark is shown by the monogram NF in compliance with the model below (English and French version):

Referring to www.certita.org and type of heat pump (i.e.: heating – pool) can be mentioned below the logo on two lines maximum based in compliance with the NF graphic design charter.

The graphic tools for the logo are available from EUROVENT CERTITA. The NF mark graphic design charter is also available from AFNOR Certification, on request.

2.4.3 Marking process

This paragraph describes both the process for affixing the NF logo and the marking of the certified features and/or characteristics. A “certified feature” is any information for which the content is controlled under the NF mark scheme.

Any reproduction of the NF logo shall be made in compliance with the graphic design charter.

2.4.3.1 Marking the certified product

The NF logo shall be permanently and indelibly affixed to the thermodynamic device for which the right to use the NF-Heat Pump mark has been granted.

The marking of the product shall comply with the logo mentioned in § 2.4.2.

For splits, the NF logo shall be affixed to the outdoor and indoor units. However, if not all the units offered in the holder’s catalogue are covered by the combinations defined in the ranges for which the NF mark has been granted; no NF logo shall be affixed. In this case, the holder must make the following wording appear in the indoor and outdoor unit rating plates “Combinations admitted for the NF mark: see installation and user manuals”.

2.4.3.2 Reproduction of the NF logo on the packaging of the certified product

When the packaging mentions the NF mark, it shall include the NF logo in accordance with the graphic design charter.

2.4.3.3 Reproduction of the NF logo on documentation and in advertising

(Technical and commercial documents, labels, posters, advertising, websites, etc.)

The NF logo must be reproduced on the documentation in accordance with the corporate identity and if applicable with the conditions for which the products benefit from the right to use the NF mark, as defined in paragraph 2.4.3.1.

The holder shall only use the NF mark on the document to distinguish certified products and where there is no risk of confusion and interpretation. For this reason, the publications shall include a chapter explaining the scope of the certificate. Information on the mains reasons and benefit of using a certified product will be given to the user.

Reproduction of the NF mark on the holder’s letterhead is not allowed, unless the holder has the NF mark for all production.

2.4.3.4 Examples of additional information that can be given with the marking

- Name and address of manufacturer,
- Product designation,
- Identification of the certification reference standard,
- Certified features,
- Certificate number,
- Details of the overall construction, including the dimensions and weight,
- Identification of the main components,
- Detailed user’s instructions, including the explanation of any marking using a symbol,
- The details of all operating maintenance required as well as its frequency,
- Information about how to deal with a fault,
- Product operating condition,
- Reference to environmental noise regulations.

2.4.4 Information on certified characteristics / performances

In the NF certification system, certified performances must appear at least on one of the supports (product, packaging, documentation).

Without prejudice to the sanctions laid down in the general rules of the NF mark, any incorrect announcement of the certified features exposes the holder to legal proceedings for fraud and/or misleading advertising.

2.4.5 Provision on documentation

The purpose of this paragraph is to set out the additional requirements of the NF mark, to be shown in the holder's documentation (technical, installation and sales documents, manuals, websites, etc.).

- For refrigerated circuits loaded on the site of use, the holder must indicate the instructions on assembly, loading and overall verification of the tightness of the appliance in the installation manual. The holder may refer to standard ISO 5149-2 to define the installer's obligations.
- For heat pumps using ground water and for which the certified features have been determined without barrier exchanger, the holder must clearly mention near the announcement tables the text: "Tests to assess the performance of the heat pumps have been carried out without barrier exchanger. If this component is used on the installation, the performances are reduced and the stated features no longer certified".
- For heat pumps that cannot be marked with the NF logo, as defined in paragraph 2.4.3.1, the holder shall produce a specific chapter entitled "combinations permitted for the NF mark" that reproduces the certificates of right of use of the NF mark
- For splits, if all the units offered in the holder's catalogue are not covered by combinations defined in the ranges allowed to use the NF mark, the installation and user manuals must contain a chapter "combinations allowed to use the NF mark", which must include a copy of the certificate of right to use the NF mark.
- For multi-application heat pumps, of which not all of the applications would be admitted for the NF mark, the installation and user manual must state the applications for which the product benefits from the NF mark.

2.4.6 Draft documentation

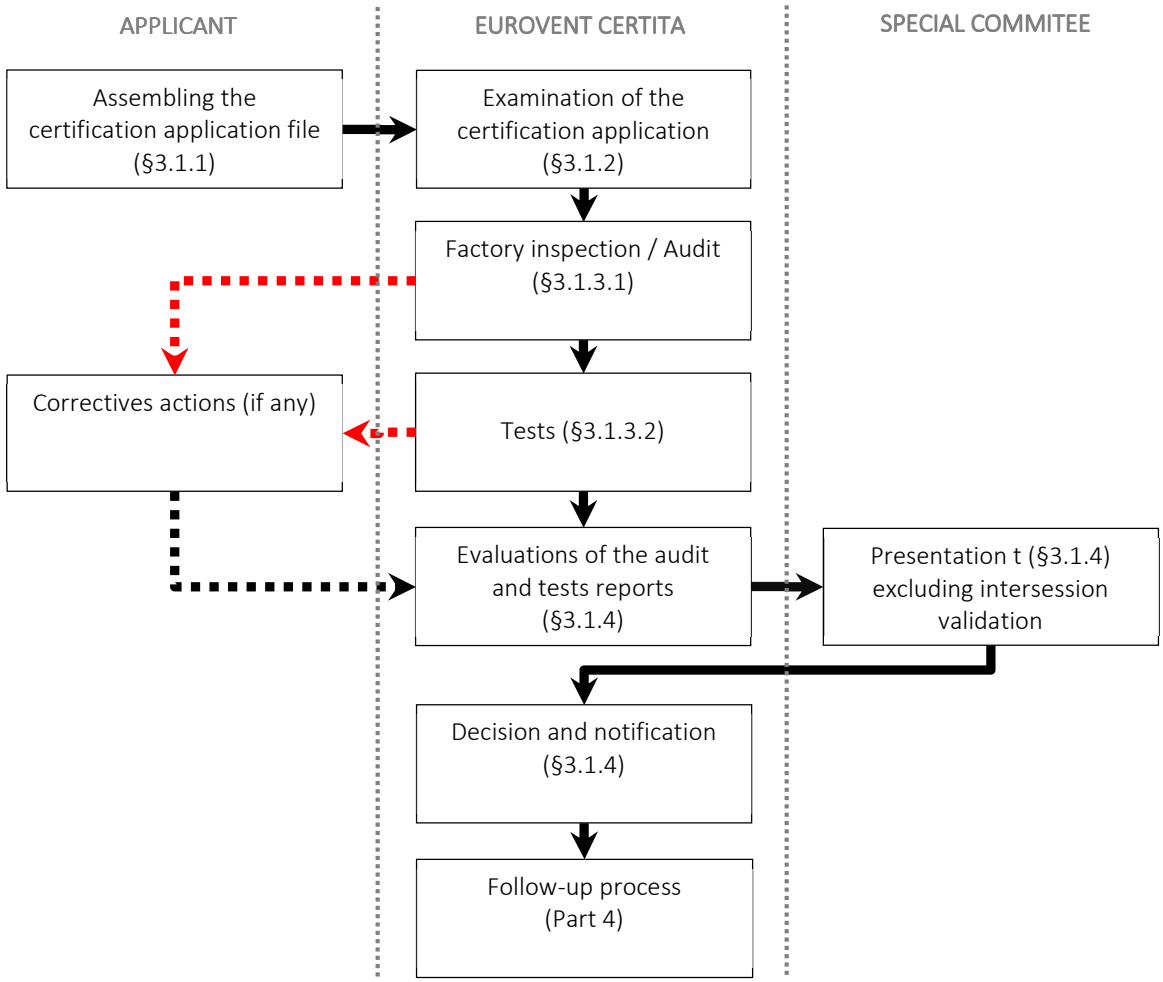
So that the holder ensures that the requirements of the NF mark are correctly interpreted and to avoid any return of document(s), it is recommended to send it (them) to EUROVENT CERTITA for review.

Part 3
HOW TO OBTAIN CERTIFICATION

An application for the right to use the NF mark can be:

- a first request for admission: this is submitted by an applicant who does not have the right to use the NF Mark in the application concerned. This corresponds to a product (or a range of products) from a particular production unit, defined by a trademark, a commercial reference specific to the product introduced and its technical features;
- a request for later admission of a new product or a new manufacturing unit: this is submitted by an applicant who has the right to use the NF Mark in the application concerned;
- an extension application for a product whose certified features have been modified (or in a modified range), or an addition of model(s);
- an application to maintain use for an NF certified product that will be marketed with a different brand and/or commercial reference without any change in its certified features.

3.1 PROCESS



3.2 CASE OF AN INITIAL APPLICATION

3.2.1 Presentation of the certification application file

Before making the application, the applicant must be sure to meet, at the time of the application, the conditions defined in these Certification Rules, especially those in Part 2, regarding the corresponding product and sites. He must undertake to comply with said conditions throughout the period of use of the NF mark.

The application shall be presented in accordance with the conditions and templates included in Part 8.

Upon receiving the application, EUROVENT CERTITA checks that all required documents are attached to the application and sends back an acknowledgement of receipt.

3.2.2 Admissibility study of the certification application

EUROVENT CERTITA checks then that the products included in the application fulfil the technical specifications established in Part 2 of these Rules. EUROVENT CERTITA may request additional information required for the admissibility of the file when this is incomplete or incorrect.

Once the application is admissible, EUROVENT CERTITA organises the inspections, and informs the applicant about the organisation methods (auditor, duration of the audit, audited sites, laboratories, sampled products, etc.).

3.2.3 Inspection methods

The inspections carried out for the NF mark are generally of two different types:

- audits conducted during visits to the manufacturing units;
- tests on the submitted products.

3.2.3.1 Audits

Each audit is performed by an audit body (see §5.2) chosen by EUROVENT CERTITA as audit leader.

The audit will last least **one day**.

The visit, carried out by an NF inspector/auditor, has the purpose of ensuring that the measures defined and implemented by the applicant during the audited design and/or manufacturing and or marketing process meet the corresponding requirements established in Part 2 of these certification rules. The report(s) shall, when required, include a response request within a time frame set in the report cover letter.

For situations in which the company subcontracts a part of their activity, EUROVENT CERTITA reserves the right to send an NF inspector/auditor to visit the subcontractor(s) in the same terms established in these rules.

The inspector/auditor must be provided with all the resources necessary (offices, installations, facilities) to perform the assignment, including competent people to carry it out.

Samples may be identified and/or taken during the visit for examinations or tests.

An observer, bounded to the respect of confidentiality (this observer is chosen by EUROVENT CERTITA by standards and agreements which he has signed), can take part to the audit. The holder is systematically informed by EUROVENT CERTITA of the presence of this observer prior to the audit.

For each audit, an audit report is prepared and sent to the applicant. This report, depending on each case, can be sent to the applicant before or after the evaluation. It can be sent by the auditor, the inspection body or EUROVENT CERTITA. Each report showing a remark or a non-conformity requires an answer within a timeframe fixed within the report or the accompanying letter.

3.2.3.2 Tests

The tests are performed under the NF Mark laboratories' responsibility.

Each test is performed by one recognised laboratory (see §5.3) chosen by the applicant. Depending on the nature of the equipment and test and study means of the applicant, EUROVENT CERTITA may, for some categories of appliances that have been or will be defined, authorise the applicant to conduct the required tests in the applicant's own laboratories according to a specified procedure described in Part 6.

The tests are carried out in accordance with the standards and additional specifications established in Part 2.

A test report is drawn up and sent to the applicant and to EUROVENT CERTITA.

Each product range shall be tested depending on its admission as indicated in the table below:

Number of products in the range	Number of products tested
From 1 to 5	1
From 6 to 10	2
From 11 to 15	3
> 16	3 (up to 15 then 1 additional reference per step of 5)

For acoustic power characteristics, 1 product shall be subject to testing regardless of the number of products in the range.

For dual-mode heat pumps, the test programme and the number of products to be tested are defined in Appendix C, § C.4.

For multi-split heat pumps:

The number of tested product(s) is determined by taking account of the table above. It is used to define the number of outdoor units (OUs) and number of indoor units (IUs) for each type (apron wall, wall, ceiling, etc.). Multiplication of the number of OUs by the number of IUs selected produces the maximum number of combinations to test.

In view of the test method and test means of the laboratory, i.e.:

- IU connection of the same model in the same range,
- Provision of two or even three climatic chambers to test a combination with two types of IU, if necessary.

Together with the laboratory, EUROVENT CERTITA shall study the combinations that may be tested carefully, to minimise the number of tests validating all of the OU and IU models selected.

Moreover, depending on the combinations selected, it will at least:

- test a combination that reaches 80% of the nominal capacity of the associated OU during operation (at 7/6_20/15 °C) and,
- test a combination that reaches 120% of the nominal capacity of the associated OU during operation (at 7/6_20/15 °C).

None of the other combinations will have to meet a specific criterion within the 80%-120% range of capacity of the OU.

3.3 EVALUATION AND DECISION

EUROVENT CERTITA assesses each report intended for the applicant in accordance with the current procedures. Each report showing deviation out of tolerance requires an answer within a timeframe fixed within the report or the accompanying letter. The applicant must present, for each deviation, the actions taken or to be taken, including the schedule to put them in place.

EUROVENT CERTITA analyses the relevance of the response and is entitled to request an additional inspection (full or partial audit and/or tests).

If necessary, EUROVENT CERTITA may anonymously present all evaluation results to the Special Committee for review.

Depending on the results of all inspections, EUROVENT CERTITA notifies one of the following decisions:

- Certification
- Certification rejection

If certification has been approved, AFNOR Certification authorises the use of the NF mark, and EUROVENT CERTITA sends the applicant, who is now a mark holder, the NF certificate and/or letter notifying the decision.

The methods for communicating about the certification are defined in Part 2.4 of these certification rules.

The applicant may object to the decision made by submitting a claim in accordance with the General Rules of the NF Mark.

3.4 CASE OF A SUBSEQUENT APPLICATION

The application shall be presented in accordance with the conditions and templates included in Part 8.

The stages described in §3.2 and 3.3 are applicable. The audit can be adapted or combined with a monitoring audit.

3.5 CASE OF AN APPLICATION FOR EXTENSION

The application shall be presented in accordance with the conditions and templates included in Part 8.

The stages described in paragraph 3.2 will be applicable subject to the following specific features:

For dual-mode heat pumps, the test programme and the number of products to be tested are defined in Appendix C, § C.4.

For other product categories:

- In the case of a request for extension for a certified range of products that is modified, the tests defined will depend on the envisaged modification.

  The number of products to be tested is defined as follows:

Number of products in the range	Number of products tested
From 1 to 5	1
≥ 6	2

- for extension applications for the addition of products to a certified range, having the same components as defined in § 3.1.1, the number of products to be tested is determined by adding the added products to those already certified.

  The number of products to be tested is defined as follows:

Number of products in range (after addition of models)	Number of products tested
From 2 to 5	0
From 6 to 10	1
From 10 to 15	2
≥15	2 (up to 15 then 1 additional reference per step of 5)

- for an application for extension corresponding to the addition of an application (new matrix line) for an already certified range, the number of tests to be made to certify this new application is set at 1 on a model from the range.
- the audit can be adapted or combined with a monitoring audit.

3.6 CASE OF AN APPLICATION FOR MAINTENANCE

The application shall be presented in accordance with the conditions and templates included in Part 8.

For distribution through different trademarks, certain modifications in appearance may be made to the products in question if they do not entail any functional change. The manufacturer shall then specify in the maintenance application the list of modifications made to the products in question. EUROVENT CERTITA ensures that said modifications have no impact on function.

Part 4
CERTIFICATION MONITORING

Throughout certification, the holder must:

- comply with the requirements defined and the marking methods described in Part 2;
- update the certification file;
- Systematically inform EUROVENT CERTITA of any change in the features of the certified product.

EUROVENT CERTITA shall follow up the certified products as soon as the right to use the NF Mark is granted. This follow up includes audits and tests on the products.

It also includes monitoring of how the mark and logo are used on products and every communication document.

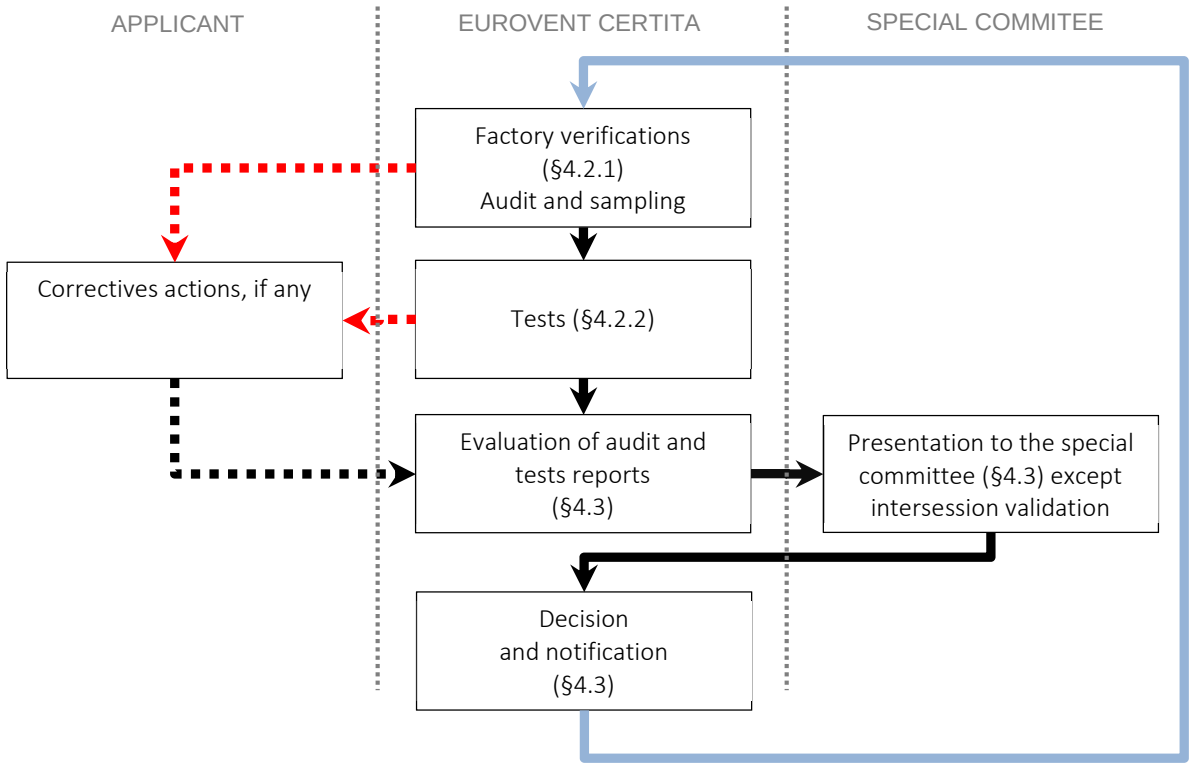
The NF mark is awarded to a product from a particular manufacturing unit, defined by a trademark, specific commercial reference and technical characteristics. As a result, any modification to the conditions to obtain the NF mark must be reported by the holder in writing to EUROVENT CERTITA.

In addition, EUROVENT CERTITA is entitled to carry out or have carried out any additional audit or test it deems necessary as a result of complaints, disputes or litigations they are aware of in connection with the use of NF mark.

Inspections may be carried out on the market.

In the event of disputes with users, inspections may include sampling or tests on the sites of use (in this case, the holder is invited to send a representative there).

4.1 PROCESS



4.2 METHODS FOR FOLLOW-UP INSPECTIONS

The follow-up methods depend on the decisions made as a result of previous inspections.

4.2.1 Audits

4.2.1.1 Purpose

Each audit is performed by an audit body (see §5.2) chosen by EUROVENT CERTITA as audit leader.

The visit has the purpose of ensuring that the measures defined and implemented by the applicant during the audited design and/or manufacturing and or marketing process meet the corresponding requirements established in Part 2 of these certification rules.

For situations in which the holder subcontracts a part of their activity, EUROVENT CERTITA reserves the right to send an auditor to visit the subcontractor(s) in the same terms established in these rules.

The inspector/auditor must be provided with all the resources necessary (offices, installations, facilities) to perform the assignment, including competent people to carry it out.

Samples may be identified and/or taken during the visit for examinations or tests.

An observer, bounded to the respect of confidentiality (this observer is chosen by EUROVENT CERTITA by standards and agreements which he has signed), can take part to the audit. The holder is systematically informed by EUROVENT CERTITA of the presence of this observer prior to the audit.

For each audit, an audit report is prepared and sent to the holder. This report, depending on each case, can be sent to the applicant before or after the evaluation. It can be sent by the auditor, the inspection body or EUROVENT CERTITA. Each report showing a remark or a non-conformity requires an answer within a timeframe fixed within the report or the accompanying letter.

4.2.1.2 Frequency of the audit visits

The audit will last at least **one day** and be carried out **once a year**.

Normal monitoring of the manufacturing units

The normal frequency is **one audit per year for each manufacturing unit**.

Reduced monitoring of manufacturing units

After the first follow-up audit has been performed, the normal audit frequency of one year may be brought to one audit every 2 years if the holder complies with the following conditions:

- any deviations found during the previous audit are resolved and the actions put in place are effective,
- the audit did not highlight any critical deviation from the NF HP requirements, i.e., any deviation that calls into question the compliance of the product with the requirements of the NF HP standard,
- the follow-up test results are available and comply with reference specifications.

Once reduced monitoring has been set up, non-compliance with one of the above 3 conditions leads to a return to normal monitoring and therefore an annual audit.

Increased monitoring schedule

In the event of breach of these certification rules, the increased monitoring procedure may be set up for a defined period of time. This may be adjusted as far as doubling the normal frequency of audits, with or without increasing the manufacturer's inspections and samples for the tests.

4.2.2 Tests

Each year, holder's products are sampled for tests.

As soon as the holder has a certified range, products are sampled annually. As soon as a dual-mode heat pump is certified, a dual-mode heat pump is preferably sampled. As soon as two ranges or more are certified, two products from different ranges are sampled annually.

The products to be sampled are chosen by EUROVENT CERTITA, who informs the holder of the appliances to be manufactured in advance in order to enable the auditor to identify them during the audit

assignment. In the absence of a monitoring audit, EUROVENT CERTITA approaches the holder to tell it which products to manufacture and organise their sampling.

Tests are performed in a recognised laboratory (see §5.3) in accordance with the rules fixed in Part 2 §2.2. A test report is produced by the laboratory and sent to the holder by EUROVENT CERTITA.

For those holders who have an authorised laboratory (see Part 6), one of the two sample products shall be subject to an inter-comparison with a recognised laboratory. The other product can be tested in its authorised laboratory, a test report is drawn up and sent to EUROVENT CERTITA.

For each HP type, the allowable tolerances relative to the certified values are given in part 9.

When considering a range of products, if the test results for a sample product are different from the certified features, except from the defined tolerances, all the values of the certified features of the range must be changed on the basis of the test report results for the tested product.

4.3 EVALUATION AND DECISION

EUROVENT CERTITA assesses each report in accordance with the current procedures. Each report showing deviation out of tolerance requires an answer within a timeframe fixed within the report or the accompanying letter. The applicant must present, for each deviation, the actions taken or to be taken, including the schedule to put them in place.

EUROVENT CERTITA analyses the relevance of the response and is entitled to request an additional inspection (full or partial audit and/or tests).

If necessary, EUROVENT CERTITA may present all of the evaluation results anonymously to the Special Committee for review.

Depending on the results of all inspections, EUROVENT CERTITA notifies one of the following decisions:

a) Renewal of certification: This renewal may be include comments or a request for corrective action, if necessary. If a decision to uphold certification has been made, AFNOR Certification upholds the right to use the NF mark.

b) Renewal of certification with a notice to correct any detected breach within a specific time frame. This conditional renewal may or may not be accompanied by increased inspections, testing or audits.

c) Suspension of certification (suspension has a maximum duration of one year. After this, withdrawal of certification is pronounced).

d) Withdrawal of certification. If a decision to suspend or withdraw certification has been made, AFNOR Certification suspends or withdraws the right to use the NF mark.

For sanctions b), c) and d), the fees for additional verifications are charged to the licensee, regardless of their results. The decisions are enforceable as from the date of notification.

Holders are responsible for the right to use the NF mark relative to the product concerned and agree to implement the actions arising from the suspension or withdrawal of the right of use, made in accordance with these certification rules.

All suspensions and withdrawal of the right to use the NF mark lead to the interdiction to use the mark and reference to it for all new production. For products manufactured prior to the suspension or withdrawal of the right of use, the certifier may implement special measures on a case by case basis.

The methods of communication about certification are set out in § 2.4 of this certification standard.

The holder may object to the decision made by submitting a claim in accordance with the General Rules of the NF Mark.

4.4 MODIFICATIONS STATEMENT

This paragraph states what information is needed and the steps to take in the event of modifications concerning:

- the holder;

- the manufacturing unit,
- the quality organisation of the manufacturing unit,
- the product.

For other cases, EUROVENT CERTITA determines whether the modifications could cast doubt over the certification and whether an additional inspection is necessary.

Depending on the examination results, EUROVENT CERTITA notifies the appropriate decision.

4.4.1 Modification concerning the holder

The holder shall report in writing to EUROVENT CERTITA any legal modification of the company or any change in the company's name.

In case of merger, liquidation or absorption of the holder, all the rights to use the NF Mark from which the holder may benefit cease automatically.

A new application may be submitted, and its examination reduced depending on the modifications.

4.4.2 Modification concerning the manufacturing unit

The holder shall declare the transfer in writing to EUROVENT CERTITA who organises an audit of the new manufacturing site, and if necessary, also performs tests.

Any transfer (total or partial) of the manufacturing unit of a certified product to a different manufacturing unit brings about an immediate cessation of marking by the holder on the products concerned.

The visit may be reduced, or even unnecessary, when the new site is already known by EUROVENT CERTITA.

The methods for assessing and deciding upon a renewal of the certification are the same as those described for admission in Part 3.

4.4.3 Modification concerning the quality organisation of the manufacturing unit

The holder shall report in writing to EUROVENT CERTITA any modification regarding its quality organisation that could have an impact on the conformity of production to the requirements of these certification rules (modifications regarding its facilities, quality plans, etc.).

Any certification modification of the quality management system must be declared in particular.

If internal inspection of a certified product is temporarily suspended, the holder must cease NF marking immediately.

EUROVENT CERTITA then notifies a decision to suspend the right to use the NF mark for a specific period. If the right of use cannot be reinstated at the end of this period, it will be withdrawn.

4.4.4 Modification concerning the NF certified product

Any modification of the certified product with respect to the application file, the accepted model or the rules defined in the certification reference standard which is likely to have an impact on product conformity to the requirements of these certification rules must be subject to a written declaration to EUROVENT CERTITA.

EUROVENT CERTITA determines whether this constitutes an application to extend the certification.

4.4.5 Temporary or definitive cessation of production

Any definitive or temporary cessation of production of an NF certified product or any abandonment of the right to use the NF mark shall be declared in writing to EUROVENT CERTITA, specifying the period of time required to use up the stock of NF marked products. The suspension or withdrawal of the right to use the NF mark shall be notified by EUROVENT CERTITA.

Any temporary cessation of production of a range of NF certified products, deemed to last for too long by EUROVENT CERTITA, possibly after consulting the Special Committee, may, after an investigation, lead to the suspension or withdrawal of the right to use the mark for these products.

Part 5
INVOLVED BODIES

The bodies involved in the procedure to grant the right to use the mark and to monitor the certified products are specified below. Controls are realised by recognised audit bodies or European laboratories, bound with EUROVENT CERTITA by an outsourcing contract. After approval by the special committee and with agreement by AFNOR certification, controls can be carried out by other organisms than the ones listed below.

5.1 MANDATED BODY

In accordance with the General Rules of the NF mark, AFNOR Certification entrusts the different tasks required to manage the "Heat Pump" NF Mark to the following body, called the mandated body (M.B.):

EUROVENT CERTITA
48-50, rue de la Victoire
F- 75009 PARIS
☎ : + 33 1 75 44 71 71
Website: www.certita.org - Email: certita@certita.fr

5.2 AUDIT BODY

The audit functions for the manufacturing unit, and possibly for the sites of use, are carried out by the following body, called the **audit body**:

EUROVENT CERTITA
48-50, rue de la Victoire
F- 75009 PARIS
☎ : + 33 1 75 44 71 71
Website: www.certita.org - Email: certita@certita.fr

LNE
1, rue Gaston Boissier
F-75724 PARIS CEDEX 15
☎ : + 33 1 40 43 37 00
🗐 : + 33 1 40 43 37 37
Website: www.lne.fr - Email: info@lne.fr

The auditors are entitled to inspect the applicant's or holder's facilities, in order to perform their mission.

5.3 TEST BODY

Each test (except those carried out in "authorised laboratories", cf. Part 6) is performed at EUROVENT CERTITA's request in one of the following laboratories, called **mark laboratories**.

5.3.1 Thermal tests and acoustic tests

CEIS
Ctra. Villaviciosa de Odòn a Móstoles km 1.5
28935 Móstoles – MADRID – SPAIN
☎ : + 34 91.616.97.10
🗐 : + 34 91.616.23.72
Website: www.ceis.es – Email: ceis@ceis.es

CETIAT
Domaine scientifique de la Doua - 25 Avenue des Arts
B.P. 2042
69603 Villeurbanne Cedex - FRANCE
☎ : + 33 4.72.44.49.00
🗐 : + 33 4.72.44.49.49
Website: www.cetiat.fr - Email: cetiat.commercial@cetiat.fr

LNE
29 avenue Roger Hennequin
F-78197 TRAPPES Cedex
☎ : + 33 1 30 69 10 00
🗐 : + 33 1 30 69 12 34
Website: www.lne.fr - Email: info@lne.fr

SP Technical Research Insitute of Sweden
Energiteknik / Energy Technology
Box 857, SE-501 15 Borås, Sweden
☎: +46 10 516 50 00,
🗐: +46 33 13 19 79
Website: www.sp.se - Email: info@sp.se

5.3.2 Thermal tests

AIT
Öterreichisches Forschungs – und Prüfzentrum Arsenal Ges.m.b.H
Giefinggasse 2
1210 Vienna - Austria
☎: +43 50550-6509,
🗐: +43 50550-6679
Website: www.ait.ac.at

5.4 SPECIAL COMMITTEE OF THE NF MARK

There is an advisory body called a Special Committee of the NF mark, in which EUROVENT CERTITA has a secretarial role. Its members are as follows:

- Manufacturer panel: 3 to 7 representatives,
- User/specifier panel: 1 to 6 representatives,
- Technical body panel: 1 to 5 representatives,
- Public authority panel: 1 to 2 representatives.

A Chairman is appointed from the members of the one of the above panels.

The Committee issues decision opinions and its members are not allowed to receive any compensation for the functions they perform.

The length of the delegation period of the members is 3 years. This delegation period is renewable by tacit agreement. The Committee Chairman can change every year.

During their sessions, the Special Committee can assign certain tasks to a working group whose members must be appointed from among the members of the Special Committee and whose mission shall be defined.

Special Committee members undertake to fulfil their function with impartiality and keep personal information disclosed to them confidential. EUROVENT CERTITA takes the specific measures to ensure the confidentiality of applicant or holder files presented to the Committee (except authorisation or in the event of disputes/appeals).

Part 6
USE OF HOLDERS'/APPLICANTS' LABORATORIES

This part describes the procedure according to which an applicant/holder may be authorised to conduct, in their own laboratories, all or part of the tests required for examining an application submitted. If the tests are performed partially, then the remaining tests are to be performed in a mark laboratory.

The appliances admitted by this procedure are subject to a systematic inspection according to § 4.2.2.

When the authorisation is granted, it is said that the applicant/holder has obtained an "NF authorisation", and the laboratory(ies) involved are said to be "NF authorised". The NF authorisation of a laboratory applies only for the NF mark application, and any mention of this authorisation in a different context is prohibited.

6.1 NF AUTHORISATION REQUEST

Prior to the NF authorisation request, a comparison between the applicant/holder's laboratory and one of the independent laboratories of the mark is carried out on one appliance.

The NF authorisation request must be sent to EUROVENT CERTITA, indicating the tests for which the NF authorisation is required, out of those subject to the accreditation, with the following attachments:

- a copy of the accreditation decision from the accreditation body (COFRAC in Frnace, or equivalent recognized by European cooperation for Accreditation) stating its limitations (type of tests concerned);
- the report(s) drawn up by the accrediting body as part of its accreditation procedure and any subsequent reports of verifications carried out by the latter;
- the commitment to comply with the relevant provisions of the certification rules and of the parts thereof.

The costs of all aforementioned operations will be borne by the applicant.

6.2 NF AUTHORISATION APPROVAL AND AUTHORISATION PERIOD

EUROVENT CERTITA studies the request, checks that it is complete and approves or rejects the NF Authorisation specifying the reasons, or adjourns the decision by recommending an additional investigation.

The Special Committee is informed of the authorisations granted.

The authorisation is valid for a maximum period of two years.

6.3 VERIFICATION AND RENEWAL OF THE AUTHORISATION

The authorised laboratory keeps EUROVENT CERTITA regularly informed of the verifications performed by the accreditation body and the decisions the latter makes after these verifications as part of its accreditation follow-up.

This information, together with the results of the verifications made under these certification rules ("systematic" and other verifications) are examined by EUROVENT CERTITA which, after evaluation, recommends upholding, suspending or withdrawing the NF authorisation for all or part of the tests.

Any total or partial suspension or withdrawal of accreditation will lead to a new evaluation of the laboratory status regarding the NF mark. EUROVENT CERTITA gives a verdict, in the light of the investigation performed by the accrediting body, and the reasons for refusing accreditation.

EUROVENT CERTITA lays down the conditions applying to this possible renewal, indicating the verifications to be carried out.

6.4 INTER-LABORATORY TESTS

Every year, the accredited laboratory of an applicant/holder and one of the mark laboratories carry out standardised tests on 1 appliance presented for admission or sampled for this purpose. The test reports are submitted to EUROVENT CERTITA for a comparison of results. If anything abnormal is found, the managers of both laboratories will take the appropriate corrective actions, under EUROVENT CERTITA supervision.

After examining the test results, EUROVENT CERTITA will be able, if required, and possibly after consulting the Special Committee, to request further tests.

The costs of tests performed in the independent laboratory are borne by the applicant/holder.

EUROVENT CERTITA is in charge of following up these tests.

6.5 AUTHORISATION PROCEDURE FOR AN APPLICANT/HOLDER LABORATORY WITH RESPECT TO THE NF MARK

Applicant/Holder	EUROVENT CERTITA	Mark laboratory
Phase 1		
• sends a complete application file to CERTITA, in 1 copy, according to article §6.1. Besides, the application must specify the name of the independent mark laboratory that the manufacturer would like to perform the comparison test of phase 2.	• records the application and verifies that it is complete, • processes the application, • informs the independent mark laboratory that has been selected, • issues the corresponding invoice to the manufacturer.	
Phase 2		

• conducts the NF conformity tests,
• draws up the corresponding test report,
• sends to the mark laboratory:
  • the test report,
  • documentation for the tested appliance
• keeps the tested appliance available for the independent mark laboratory,
• issues a test evaluation request for test comparison to the independent laboratory
		• conducts the inter-comparison test,
		• draws up the corresponding test report,
		• submits the report to CERTITA and to the manufacturer,
		• issues the corresponding invoice to the manufacturer.

Phase 3		
	• examines the whole file (inter-comparison test results, etc.), • makes a decision based on the results, • notifies its decision to the manufacturer, submitting a copy to the laboratory of the mark in question. The certificate specifies the NF authorisation scope (applicable documents, complete or partial tests).	
Phase 4		
	• Examines the renewal procedure according to the provisions of Part 6.	

6.6 PROCEDURE FOR TESTS CARRIED OUT BY AN "AUTHORISED NF" LABORATORY (ACCORDING TO ITS AUTHORISATION SCOPE)

Applicant/Holder	EUROVENT CERTITA	Mark laboratory
Phase 1		
In case of an application • sends EUROVENT CERTITA an application file, following §3.2, 3.4, or 3.5 **In case of an application or a follow-up** • informs EUROVENT CERTITA of the chosen authorised NF laboratory for the device concerned • with a view to conducting the examination, sends the mark laboratory the report of the tests conducted in its NF authorised laboratory as part of its application, in duplicate.	**In case of an application** • assigns a file number to the application • processes the application • issues the corresponding invoices (admission and report evaluation costs), **In case of an application and follow-up** • records the location of the test of the concerned device • issues the corresponding invoices • sends a copy of the application to the mark laboratory.	• examines the test report submitted by the manufacturer, • makes or has carried out the modifications or supplementary information, if necessary, in agreement with EUROVENT CERTITA, • sends CERTITA the test report and the examination conclusions.
Phase 2		
• send a corrective actions plans in case of non-conformities	• complete the application of the applicant/holder by results send by the mark laboratory • evaluate the report and the corrective action plan in case of non-conformities off-tolerance • evaluate the relevance of the answer	
Phase 3		
	• notify the decision to the applicant/holder according to the NF certification procedure	

Part 7
RATES

7.1 SERVICES RELATING TO NF CERTIFICATION

Type of service	Service definition	General conditions common to NF marks
Registration	Contribution to setting up the NF mark including drawing up the certification standard.	The registration fees are paid by the company during an initial application for the right to use the NF mark. Payment of these services will not be reimbursed, even if the right to use the NF mark is not granted or if the application is abandoned during processing.
Processing of the certification application	Services associated with examining application files, with relations with applicants, laboratories, auditors or the assessment of inspection results.	This service is invoiced as soon as the application is received. It is charged at a flat rate. Payment of these services will not be reimbursed, even if the right to use the NF mark is not granted or if the application is abandoned during processing.
Administration of certification application	Services for managing applications for certified products and their holders, drawing up lists of certified products, and assessing inspection results.	
Tests	Test services corresponding to laboratory rates.	The laboratories' rates are provided on request. Payment of these services will not be reimbursed, even if the right to use the NF mark is not granted or if the application is abandoned during processing

Type of service	Service definition	General conditions common to NF marks
Audit	Services including audit preparation, the audit itself and the report. Travel expenses will be added to these services.	Payment for these services will not be reimbursed, even if the right to use the NF mark is not granted or renewed
Right to use the NF mark	This licence fee due to AFNOR Certification is intended to cover: • general operation of the NF Mark (organisation of quality assurance, monitoring of bodies in the NF network, management of the NF mark committee) • protection of the NF mark: filing and protection of the mark, legal counsel, processing of appeals, legal services, • contribution to the general promotion of the NF mark	The annual rate for the right to use the NF mark is invoiced to the holder after certification of a product.
Additional inspections	Services incurred by additional inspections or verification tests that may prove necessary following inadequacies or abnormalities revealed by current inspections	These services shall be borne by the manufacturer at the current rates, available on request.
Promotion	Sector-based promotion actions of the NF mark	Service for which the amount is defined every year and invoiced in addition to the other services

7.2 COLLECTING PAYMENT FOR SERVICES

The registration fee and costs for the examination and inspection services invoiced as part of an application to accept or extend the right to use the mark must be paid all at once, when the application is submitted, with a view to registering it officially. They will not be reimbursed even if the right of use is not granted or extended.

The costs concerning the annual follow-up services and the right of use are issued once a year, at the beginning of the year. All applications to surrender the right to use the NF mark shall reach EUROVENT CERTITA by 31 December of the current year at the latest, so that the range of heat pumps is not taken into account in the following year. These costs remain payable in the event of non-renewal, cancellation or suspension of the right of use during the year.

EUROVENT CERTITA is in charge of transferring the share due to AFNOR CERTIFICATION.

The applicant or the holder of the usage right must pay all the expenses in the following prescribed conditions: any failure on their part is in fact an obstacle to the exercise by EUROVENT CERTITA of the inspection and intervention responsibilities that are incumbent on it under the present regulations.

In cases where an initial formal notice by registered letter with acknowledgment of receipt does not result in full payment of all sums due within one month, any penalty provided for in the general rules of the NF mark may be taken for all of the holder's admitted products.

7.3 RATES

The costs are subject to a rates list distributed by EUROVENT CERTITA on request at the beginning of each year.

Part 8
CERTIFICATION FILES

The application for the right to use the NF Mark must be drawn up in one hard copy, and one electronic copy, addressed to EUROVENT CERTITA in accordance with the templates defined below in French or English.

If the product comes from a manufacturing unit outside the European Economic Area, the applicant will appoint an authorised agent within the European Economic Area who jointly signs the application.

An application concerning a product availing of a foreign conformity mark or a test certificate issued by a foreign laboratory is processed according to existing recognition agreements, in accordance with the general rules of the NF Mark.

A copy of the conformity certificate/declaration to European directives must be attached to each application.

Electronic versions of letter templates and data sheets may be obtained from EUROVENT CERTITA.

8.1 "APPLICATION FILE" CHECKLIST

Documents to be provided	No. of copy
Application for the right of use according: • Standard letter 1 in case of application for the right of use or subsequent admission application • Standard letter 2 in case of application for extension of the right of use • Standard letter 3A filled in by the applicant/holder joined with the visa of the distributor (if relevant) and 3B, if the latter is not the applicant/holder of the right to use the NF mark, in case of a maintenance application	1
General data sheet regarding the applicant and the stakeholders according to the standard sheet 1	1
Commitment sheet according to standard sheet 3 In case of subcontracting (as defined in §1.2), in case of an admission or extension application in case of an admission or extension application	1
Commitment sheet according to standard sheet 4, in case of authorised agent (as defined in §1.2.2)	1
Declaration of product conformity to the European directives and regulations which are applicable according to standard sheet 5 in case of an admission or extension application	1
Wiring diagram in case of an admission or extension application	1
Specification plate: in original or copy format which must features the NF logo marking draft. For splits and multisplits, that of the outdoor and indoor units in case of an admission or extension application	1
Installation and user's manual in French	1
Distributor's commercial documentation in case of a maintenance application	1
Technical data sheet according to standard sheet 2 in case of an admission or extension application	1
Test reports, original, in Franech and/or English Note: Each test report is preferably accompanied by a synthesis examination report 1 report for every 5 models of the range (cf. §3.2.3.2)	x

8.2 SHEETS AND LETTERS MODELS

STANDARD LETTER 1: APPLICATION FOR THE RIGHT TO USE THE NF MARK or SUBSEQUENT ADMISSION APPLICATION

Heat Pump NF MARK

(To be drawn up on the applicant's headed paper)

Monsieur le Directeur Général d'EUROVENT CERTITA
NF 414 Client Manager
48-50, rue de la Victoire
75 009 PARIS (FRANCE)

RE: **"Heat Pump" NF MARK**

Application for the right to use the NF mark or subsequent admission application

Attachment(s): a technical file.

Dear Sir,

I am writing to apply for the right to use the NF Mark

- for the following commercial brand: (trade mark, trade name) .....
- for the products (reference / name of models. The products can be described in the "standard sheet 2" technical data sheet. In this case, refer thereto) .....
- manufactured in the following unit(s): (Corporate name and address, which can be described in the "standard sheet 2" technical data sheet. In this case, refer thereto) .....

In this respect, I declare knowledge and acceptance of the "General rules of the NF mark", the Heat Pump – NF mark certification rules, and undertake to comply thereto during throughout the period of use of the NF mark.

- To save this commercial brand to certified products and check it allows to distinguish them between non-certified products.
- Provide to persons in charge of the checking process (application file, tests, audits) all the necessary information in preparation of his/her examination such as documents, records, allows him/her the access of the equipment, sites workforce and subcontractors.
- To instruct record, process in the most suitable way and make claims, non-conformities, remarks, and unevenness related to the requirements of the certification available to the certification body.

<OPTION for applicants/holders out of the European Economic Area: Furthermore, I authorise the company (corporate name), (company status), (registered offices) represented by (Mr/Mrs/Miss)* (name of the representative) acting as (role) to be my agent in the European Economic Area for any question referring to the use of the "Heat pump" NF Mark.

I undertake to inform EUROVENT CERTITA immediately of any change in the aforementioned representative.

For such purposes, I ask that the fees incumbent on me be invoiced directly to him/her. S/he will directly pay them on my behalf upon receiving the invoices, as s/he so undertakes when accepting to be my representative.>

Yours faithfully,

Date and signature of the official representative of applicant

<OPTION: Date and signature of the official representative after the handwritten words "Bon pour Représentation">

<OPTION: >**Date and signature of the Representative in the European Economic Area**

<after the handwritten words "Bon pour acceptation de la représentation">

STANDARD LETTER 2: APPLICATION FOR EXTENSION OF THE RIGHT TO USE THE NF MARK

Heat Pump NF MARK

(To be drawn up on the holder's headed paper)

Monsieur le Directeur Général d'EUROVENT CERTITA
NF 414 Client Manager
48-50, rue de la Victoire
75009 PARIS (FRANCE)

RE: **"Heat Pump" NF mark**

Application for extension of the right to use the NF Mark

Attachment(s): a technical file.

Dear Sir,

- As holder of the "Heat Pump" NF Mark for the products of my own production identified by the following references:
- trade mark:

- trade name: .....
- designation of the product(s): ..... (which may be appended to the application letter);
- manufacturing unit(s) (corporate name) (address): (which may be appended to the application letter);
- right of use granted on (date) with number: .....
- I am writing to apply for the right to use the NF Mark for the products of my own production, deriving from the NF certified products with the following modifications: (description of modifications).

.....
.....
.....
.....
.....

These products, for which the extension application is made, will replace the certified products (Delete as necessary):

NO

YES

I hereby declare that the other characteristics of the products concerned by this application are in strict compliance with the products that are already NF certified and manufactured in the same conditions.

Yours faithfully,

Date and signature of the applicant's official representative

<OPTION: Date and signature of the official representative after the handwritten words "Bon pour Représentation">

<OPTION [1] Date and signature of the Representative in the European Economic Area after the handwritten words "Bon pour acceptation de la représentation">

STANDARD LETTER 3A: APPLICATION FOR MAINTENANCE OF THE RIGHT TO USE THE NF MARK

HOLDER AUTHORISATION

Heat Pump NF MARK

(To be drawn up on the holder's headed paper)

Monsieur le Directeur Général d'EUROVENT CERTITA
NF 414 Client Manager
48-50, rue de la Victoire
75009 PARIS (FRANCE)

RE: "Heat Pump" NF mark

Application for maintenance of the right to use the NF mark

Dear Sir,

I am writing to apply for the maintenance to use the NF Mark on products which differ from the products approved for the mark only by their references and trademark they bear and some adjustments which do not modify their features in any way.

For the following new trademark: .....

Identification of the NF mark admitted product		Trade name requested by distributor/beneficiary The term "Trade name" refers to any distinctive sign permitting accurate identification both of the distributor and the product		
Certificate no.	Name and reference of the manufacturer's product	Trade name	Trade name of the range	HP ref./model
xxx....				

<OPTION>: The details of the company which is going to distribute these products under the aforementioned trademark are as follows:

Name: .....

Address: .....

Please find attached a copy of the Commitment sheet of the company (distributor name) to distribute under this trade name (name or commercial reference) only the products that I deliver to it.

I undertake to inform EUROVENT CERTITA immediately of any modification made in the distribution of said products, especially of any cessation in supply to the aforementioned Company.

I authorise EUROVENT CERTITA to inform the aforementioned Company of any penalty applied taken in accordance with the Regulations, regarding the products covered by this application.>

Yours faithfully,

DISTRIBUTOR'S STAMP

Date and signature of the official Representative of the holder, maintenance applicant

STANDARD LETTER 3B: APPLICATION FOR MAINTENANCE OF THE RIGHT TO USE THE NF MARK

DISTRIBUTOR'S COMMITMENT

Heat Pump NF MARK

(To be drawn up on the distributor's headed paper)

I the undersigned .....

acting as: manager of the Ltd Company: .....
Chairman of the board; .....
Chairman of the Ltd Company .....

whose head office is at: .....

hereby undertake:

- not to make any technical modification regarding the nature and/or working features of the products described here below:

Identification of the NF mark admitted product		Trade name requested by distributor/beneficiary The term "Trade name" refers to any distinctive sign permitting accurate identification both of the distributor and the product covered by the NF mark.		
Certificate No.	Name and reference of the manufacturer's product	Trade name	Trade name of the range	HP ref./model
xxx....				

- not to make other modifications of detail on the products as manufactured by the company <manufacturer> except the following <modifications>. Any subsequent modification must be notified for agreement to EUROVENT CERTITA beforehand, and agreed with the manufacturer;
- not to modify the aforementioned trade names unless agreed by the manufacturer who holds the right to use the NF Mark;
- to distribute under these trade names only the products delivered by the company <manufacturer>;
- not to make any modification to the said trade names without having first informed EUROVENT CERTITA thereof by recorded delivery;
- not to modify any marking on the products done by the manufacturer in accordance with the provisions of the "Heat Pump" NF certification rules, which the undersigned declares to have read;
- to collaborate with EUROVENT CERTITA on any verification regarding the products in question and their marketing;
- to apply the measures resulting from penalties taken in conformity with the "Heat Pump" NF mark certification rules which the undersigned declared to have read;
- to pay the admission fees provided for by the mark rates, as well as further payments which could be asked of me in conformity with these rules.

Yours faithfully,

Date and signature of the official representative of the maintenance beneficiary

STANDARD SHEET 1: GENERAL DATA SHEET CONCERNING

Heat Pump NF MARK

THE APPLICANT

- Corporate name: .....
- Address:.....
- Country:.....
- Telephone: ..... Fax: .....
- SIRET No.[1]:..... NAF code [1] :.....
- Name and position of official representative[2]:.....
- Name and position of the correspondent (if different):.....
- VAT ID number[3]:.....
- Email address of contact person: .....
- Email address of the Company:.....
- Website: .....
- Certified quality system: ☐ ISO 9001 (attach copy of certificate)

THE MANUFACTURER

(If different from applicant/holder, above. Complete for each manufacturing site, including for internal units)

- Corporate name: .....
- Address:.....
- Country:.....
- Telephone: ..... Fax: .....
- SIRET No. [1] :..... NAF code [1] :.....
- Name and position of official representative [2]: .....
- Name and position of the correspondent (if different):.....
- VAT ID number [3]:.....
- Email address of contact person: .....
- Email address of the Company:.....
- Website: .....
- Certified quality system: ☐ ISO 9001 (attach copy of certificate)

THE AUTHORISED AGENT or DISTRIBUTOR (if necessary):

- Corporate name: .....
- Address: .....
- Country: .....
- Telephone: ..... Fax: .....
- SIRET No. [1] :..... NAF code [1] :.....
- Name and position of official representative [2]: .....
- Name and position of the correspondent (if different):.....
- VAT ID number [3]: .....
- Email address of contact person: .....
- Email address of the Company:.....
- Website: .....

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1 Only for French companies.

2 The legal representative is the legally responsible person.

3 Only for French companies.

STANDARD SHEET 3: COMMITMENT FOR SUBCONTRACTING PRODUCTION

Heat Pump – NF MARK

This sheet is provided to define the contractual links that exist between the applicant/holder and each subcontractor responsible under a subcontracting agreement for the following stages: design, manufacture (with the exception of heat pump components), assembly, inspections, marking and packaging.

This sheet must be updated whenever the contract or subcontractor changes. A copy is then sent to EUROVENT CERTITA.

Applicant / Holder: .....
Subcontractor: .....

Service identification:
(Specify depending on the definition of the applicant/holder)

Minimum requirements which must be shown in the contract:

- the subcontractor must undertake to comply with the requirements of the relevant NF – Heat pump certification standard
- management of customer complaints by the applicant/holder together with the subcontractor
- management of inter-subcontractor complaints by the applicant/holder
- regarding design, the intellectual property holder must be named; this party must inform the other party of any change in the design plans
- the subcontractor must inform the applicant/holder of any change in its quality management system, any temporary production stoppage, any production transfer and above all notify nonconformities detected during internal inspections or external audits.
- the subcontractor accepts the possible presence of a representative of the applicant/holder during the NF certification admission and monitoring audits. The subcontractor also accepts that an audit may be made by the applicant/holder to ensure compliance with the NF heat pump application certification rules.
- The subcontractor must set up measures to guarantee the availability of spare parts for a 10-year period after the product has been taken off the market.

DOCUMENTS TO DE PROVIDED:

A copy of the contract in French or English.

Contract Number/Reference:

"I certify that the minimum subcontracting requirements, above, are restated in the contract"

Date and signature of the applicant's official representative

Sheet drawn up on:

Modification dates:	Purpose of modification
1 -	
2 -	
3 - …	

STANDARD SHEET 4: IDENTIFICATION OF THE AUTHORISED AGENT'S RESPONSIBILITIES

Heat Pump – NF MARK

Applicant / Holder: .....

Authorised agent: .....

Minimum requirements which must be shown in the contract:

- assignments and associated responsibilities
- financial aspects
- complaints
- certifying body contact
- ...

Contract Number/Reference: .....

DOCUMENTS TO DE PROVIDED:

A copy of the contract in French or English.

Sheet drawn up on:

Modification dates:	Purpose of modification
1 -	
2 -	
3 - …	

Cosignature

STANDARD SHEET 5: DECLARATION OF CONFORMITY

I the undersigned .....

Acting as: manager of the Ltd Company: [4] .....
Chairman of the board; [1] .....
Chairman of the Ltd Company [1]:.....

Whose head office is at: .....

Declare that the products designated by:

- the trade mark: .....
- the trade name: .....

Meet all of the European directives and national regulations in force applicable to the products.

Moreover, I undertake to provide EUROVENT CERTITA with any certificate or declaration requested.

Date and signature of the applicant/holder's official representative

[4] Delete as necessary.

STANDARD SHEET 2: TECHNICAL DATA SHEET

The technical data sheets to be completed are provided:

- At the end of Appendix A for electrically driven heat pumps and swimming pool heat pumps,
- At the end of Appendix C for dual-mode heat pumps,
- At the end of Appendix D for gas absorption heat pumps,
- At the end of appendix E for engine-driven gas heat pumps.

Part 9
Additional specifications

Appendix A	Specific requirements for electrically driven HPs
Appendix B	Specific requirements for swimming pool HPs
Appendix C	Specific requirements for dual-mode HPs
Appendix D	Specific requirements for gas absorption HPs
Appendix E	Specific requirements for engine-driven gas HPs

Part 10
Specific test methods

Appendix AA	Acoustic tests
Appendix BB	Ground - ground HP tests
Appendix CC	Water - ground HP tests
Appendix DD	Outdoor air - ground HP tests
Appendix EE	Gas HP tests

Organisme certificateur

11, rue Francis de Pressensé
93571 LA PLAINE ST DENIS Cedex
Tél. : 01 41 62 80 00 - Fax : 01 49 17 90 00
www.marque-nf.com

Body mandated by
AFNOR Certification

48-50 rue de la Victoire
75009 PARIS
Tél. : +33 1 75 44 71 71
www.certita.fr
certita@certita.fr

CERTIFICATION REFERENCE
HEAT PUMP – NF MARK

PART 9 – APPENDIX A
SPECIFIC PROVISIONS FOR ELECTRIC HP SPACE HEATING AND COOLING

CONTENTS

Rev 8 – August 2014

A.1. SCOPE

This appendix to the NF HP rules defines the specific provisions for electric motor driven heat pumps for heating premises, including machines having a cooling function (reversible).

The products covered are defined according to the following types:

- "outdoor air/recycled air" type,
- "extracted air/fresh air" type,
- "outdoor air/water" type,
- "exhaust air/water" type,
- "(ground)water/recycled air" type,
- "water (loop)/recycled air" type,
- "glycol-water/water mix or glycol-water",
- "(ground)water/water" type,
- "ground/ground" type,
- "ground/water" type,
- "water/ground" type,
- "outdoor air/ground" type.

Only combinations (of the outdoor unit and indoor unit(s)) reaching a heating capacity in the range of 80 to 120% of the outdoor unit heating capacity during operation may be admitted for the NF mark.

A.2. CERTIFIED PERFORMANCES

The certified performances are:

- The energy performance in heating mode
  - The Coefficient of Performance (COP),
  - The heating capacity,
  - The absorbed electrical power,
- The acoustic power level.

The following performances can be optionally certified:

- The particular performances of variable power regulation HPs:
  - The minimum continuous operation Load Ratio ($LR_{contmin}$),
  - The COP at $LR_{contmin.}$
  - The performance correction coefficient at $LR_{contmin}$ ($Ccp_{LRcontmin),}$
- The share of electrical power for the auxiliaries (Ratio).
- Heat pumps seasonal performances water/air, water/water, glycol water/water, ground/water in heating mode at least for an average climate, chosen by the applicant/holder for the other climates:
  - Seasonal performance coefficient SCOP
  - Net seasonal performance coefficient $SCOP_{net}$
  - Seasonal thermal efficiency η_S
  - Note: η_S without the revaluation factor (which depends of the temperature control class)

Additionally, for the cooling function, the following performances can also be certified:

  - The Energy Efficiency Ratio (EER),
  - The cooling power.

Certification of the cooling mode can only be done with the heating mode.

The holder shall affix the NF logo making sure that any confusion exists between certified values and those which are not.

A.3. REFERENCE DOCUMENTS:

The standards mentioned in §2.2.2 are completed by the following:

- NF EN 14511-1 (December 2011): Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling
  - Part 1: - "Terms and definitions"
  - Part 2: - "Test conditions"
  - Part 3: - "Test methods".

  - Part 4: - "Requirements".
- NF EN 14825 (November 2013): Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling – Testing and rating at part load conditions.
- NF EN 15879-1 (April 2011): Testing and rating of direct exchange ground coupled heat pumps with electrically driven compressors for space heating and/or cooling - Part 1: Direct exchange-to-water heat pumps.
- Standard relating to acoustics tests (Part 10, §A.A.1).

A.4. DEFINITION OF SYSTEMS AND RANGES

A.4.1 Range

A heat pump range comprises products with the same components, namely:

- Same refrigeration process (for example, number of compressors or stages, etc.)
- same refrigerant
- same compressor type
- same expansion valve type
- same evaporator type
- same condenser type
- same defrost principle (4-way valve or vapour injector)
- same power regulation principle (refrigerant performance management)

For a split or multi-split range, the outdoor unit is characterised by the aforementioned components and the indoor units by the following components:

- same condenser type
- same fan type
- same expansion valve type (if included in the indoor unit)
- same return and discharge section geometries
- same regulation principle
- same casing type
- Same assembly type (apron wall, wall, ceiling, etc.).

A.4.2 Group of ranges

For technological reasons, it can prove necessary to change compressor technology and/or liquid refrigerant within a range. One or two products may therefore be added.

A single product that exists with single-phase and three-phase power supply constitutes two models in the same range. In this case, it must be possible to distinguish between them by their names.

A.4.3 Differentiation of ranges

In the following cases, the applicant has to fill in an applicant file for each range:

- For heat pump which are available in standard version (heating mode only) or reversible (heating and cooling and offering different trade names.
- For heat pumps that can be installed (as they are or with optional equipment) indoors or outdoors

A.4.4 Models in a range

A heat pump which offers both single-phase and three-phase supply constitutes two models in the same range. In this case, names (or commercial references) should allow to differentiate it. For heat pump offering options incorporated into the heat pump, these constitute different models if such options have an impact on the certified features of the heat pump.

A.5. TECHNICAL SPECIFICATIONS AND CHARACTERISATION METHODS

A.5.1 Operating ranges (RT 2012 matrix lines):

The operating ranges for each HP are declared by the applicant / holder and can be in whole or in part (for example an operating point) performance matrices given below and taken from RT 2012 as appropriate. The applicant/holder must, at least, declare one operating point.

Intermediate operating points (corresponding to intermediate columns of the matrices) relative to those provided by the performance matrices below can be declared for certification.

The lower upstream temperature limit is set at -15°C for outdoor air. Operating points at temperatures higher than those provided by the performance matrices below can be declared.

The matrix lines declared by the applicant / holder (corresponding to the HP operating points) do not necessarily include the RT 2012 pivot point.

According to the standard EN 14511, for some type of heat pumps, some operating points are mandatory, especially to define reference flows.

Note 1: as a reminder, if the pivot value is not certified, the certified characteristics cannot be validated under RT 2012.

A.5.2 Energy performance in heating mode

The energy performance in heating mode must be determined under the conditions below. The corresponding COP matrices appear in the § below for each HP type with the following conventions:

- When a COP value is explicitly mentioned, it defines the applicable threshold for the corresponding operating point,
- The matrix items highlighted in yellow correspond to any pivot points defined in RT 2012.

A.5.2.1 Outdoor air – water HP

The heat pump must be started up by taking an outdoor temperature of -15°C and a maximum water temperature provided by the manufacturer. The water flow rate used for the test is that corresponding to the first application requested and should preferably be at the pivot point.

For single-unit heat pumps installed indoors or for the indoor unit of split HPs, the indoor environment is at ambient temperature.

The HP must be able to start and operate for 20 minutes.

		T upstream (outdoor air) (°C)				
		-15	-7	2	7	20
T downstream (water) (°C)						
T flow	T return (*)					
25	22		2,50		4,10	
35	30		2,10		3 ,40	
45	40		1,60		2,70	
55	47		1,30		2,20	
65	55		1,20		1,90	

(*) : For an upstream temperature of 7 °C. For any other source upstream temperature, the test is performed with the nominal flow rate obtained during the 7 °C test.

A.5.2.2 Outdoor air – recycled air HP

The heat pump must be started up to validate the operating range by taking an outdoor temperature of -15°C and an indoor temperature of 15°C.

The HP must be able to start and operate for 20 minutes.

	T upstream (outdoor air) (°C)				
	-15	-7	2	7	20
T downstream (recycled air) (°C)					
5					
10					
15					
20		2,00		3 ,40	
25					

A.5.2.3 Extracted air – fresh air HP

	T upstream (extracted air) (°C)				
	5	10	15	20	25
T downstream (fresh air) (°C)					
-15					
-7				2,80	
2					
7				2,30	
20					

A.5.2.4 Ground water – water HP

		T upstream (ground water) (°C)			
	T return	5	10	15	20
	T flow	(**)	7	(**)	(**)
T downstream (water) (°C)					
T flow	T return (*)				
25	22		5,40		
35	30		4,50		
45	40		3,50		
55	47		2,80		
65	55		2,50		

(*) : For an upstream temperature of 10-7 ℃. For any other upstream source temperature, the test is performed with the nominal downstream source flow rate obtained during the 10-7 ℃ test.

(**) The nominal flow rate for the upstream source obtained during the 10-7 ℃ test is retained for the tests at other upstream source temperatures.

A.5.2.5 Glycol water – water or glycol water – glycol water HP

		T upstream (glycol water) (°C)				
	T return	-5	0	5	10	15
	T flow	(**)	-3	(**)	(**)	(**)
T downstream (water or glycol water) (°C)						
T flow	T return (*)					
25	22		4,30			
35	30		3,60			
45	40		2,80			
55	47		2,20			
65	55		1,90			

(*) : For an upstream temperature of 0-(-3) °C. For any other temperature of the upstream source, the test is performed with the nominal flow rate for the downstream source obtained during the test at 0-(-3) °C.

(**) The nominal flow rate for the upstream source obtained during the 0-(-3) °C test is retained for the tests at other upstream source temperatures.

A.5.2.6 Ground water – recycled air HP

	T upstream (ground water) (°C)			
T return	5	10	15	20
T flow	(*)	7	(*)	(*)
T downstream (recycled air) (°C)				
5				
10				
15				
20			3,30	
25				

(*) The nominal flow rate for the upstream source obtained during the 10-7 °C test is retained for the tests at other upstream source temperatures.

A.5.2.7 Water circuit – recycled air HP

	T upstream (circuit water) (°C)				
T return	10	15	20	25	27
T flow	(*)	(*)	17	(*)	(*)
T downstream (recycled air) (°C)					
5					
10					
15					
20			3,30		
25					

(*) The nominal flow rate for the upstream source obtained during the 20-17 ℃ test is retained for the tests at other upstream source temperatures.

A.5.2.8 Glycol water – recycled air HP

	T upstream (glycol water) (°C)				
T return	-5	0	5	10	15
T flow	(*)	-3	(*)	(*)	(*)
T downstream (recycled air) (°C)					
5					
10					
15					
20		3,30			
25					

(*) The nominal flow rate for the upstream source obtained during the 0-(-3) °C test is retained for the tests at other upstream source temperatures.

A.5.2.9 Extracted air – water HP

	T upstream (extracted air) (°C)				
	5	10	15	20	25

T downstream (water) (°C)						
T flow	T return (*)					
25	22				4,00	
35	30				3 ,30	
45	40				2,70	
55	47				2,20	
65	55				1,90	

(*) : For an upstream temperature of 20 ℃. For any other source upstream temperature, the test is performed with the nominal flow rate obtained during the 20 ℃ test.

A.5.2.10 Ground - water HP

	T upstream (ground) (°C) (**)
	4

T downstream (water) (°C)		
T flow	T return (*)	
25	22	4,10
35	30	3 ,40
45	40	2,70
55	47	2,20
65	55	1,90

(*) : For an upstream temperature of 4 ℃. For any other source upstream temperature, the test is performed with the nominal flow rate obtained during the 4 ℃ test.

(**) : Corresponds to the temperature of the bath glycol water

A.5.2.11 Ground - ground HP

	T upstream (ground) (°C) (*)
	-5

T downstream (ground) (°C) (**)	
35	3,40

(*) : Corresponds to the evaporation temperature

(**) : Corresponds to the condensation temperature

A.5.2.12 Water - ground HP

	T upstream (water) (°C)			
T return	5	10	15	20
T flow	(*)	7	(*)	(*)
T downstream (ground) (°C) (**)				
35		4,20		

(*) : The nominal flow rate for the upstream source obtained during the 10-7 ℃ test is retained for the tests at other upstream source temperatures.

(**) : Corresponds to the condensation temperature

A.5.2.13 Outdoor air – ground HP

The heat pump must be started up to validate the operating range by taking an outdoor temperature of -15°C and an indoor temperature of 15°C.

The HP must be able to start and operate for 20 minutes.

	T upstream (outdoor air) (°C)				
	-15	-7	2	7	20
T downstream (ground) (°C) (*)					
35		2,00		3,30	

(*) : Corresponds to the condensation temperature

A.5.3 Energy performance in cooling mode

The energy performance in cooling mode, meaning the cooling capacity, and the EER, must be determined under the conditions below. There is no defined EER threshold.

The corresponding EER matrices appear in the § below for each HP type. The matrix items highlighted in yellow correspond to any pivot points defined in RT 2012.

A.5.3.1 Outdoor air – water HP

		T upstream (outdoor air) (°C)				
		5	15	25	35	45
T downstream (water) (°C)						
T flow	T return (*)					
1,5	6,5					
7	12					
12,5	17,5					
18	23					
23,5	28,5					

(*) : For an upstream temperature of 35 °C. For any other source upstream temperature, the test is performed with the nominal flow rate obtained during the 35 °C test.

A.5.3.2 Outdoor air – recycled air HP

	T upstream (outdoor air) (°C)				
	5	15	25	35	45
T downstream (recycled air) (°C)					
22					
27					
32					
37					

A.5.3.3 Extracted air – fresh air HP

	T upstream (extracted air) (°C)			
	22	27	32	37
T downstream (fresh air) (°C)				
5				
15				
25				
35				
45				

A.5.3.4 Ground water – water HP

		T upstream (ground water) (°C)			
	T return	5	10	15	20
	T flow	(**)	15	(**)	(**)
T downstream (water) (°C)					
T flow	T return (*)				
1,5	6,5				
7	12				
12,5	17,5				
18	23				
23,5	28,5				

(*) : For an upstream temperature of 10-15 °C. For any other upstream source temperature, the test is performed with the nominal downstream source flow rate obtained during the 10-15 °C test.

(**) The nominal flow rate for the upstream source obtained during the 10-15 °C test is retained for the tests at other upstream source temperatures.

A.5.3.5 Glycol water – water or glycol water – glycol water HP

		T upstream (glycol water) (°C)				
	T return	0	10	20	30	40
	T flow	(**)	(**)	(**)	35	(**)
T downstream (water or glycol water) (°C)						
T flow	T return (*)					
1,5	6,5					
7	12					
12,5	17,5					
18	23					
23,5	28,5					

(*) : For an upstream temperature of 30-35 °C. For any other upstream source temperature, the test is performed with the nominal downstream source flow rate obtained during the 30-35 °C test.

(**) The nominal flow rate for the upstream source obtained during the 30-35 °C test is retained for the tests at other upstream source temperatures.

A.5.3.6 Ground water – recycled air HP

	T upstream (ground water) (°C)			
T return	5	10	15	20
T flow	(*)	15	(*)	(*)
T downstream (recycled air) (°C)				
22				
27				
32				
37				

(*) : The nominal flow rate for the upstream source obtained during the 10-15 °C test is retained for the tests at other upstream source temperatures.

A.5.3.7 Water circuit – recycled air HP

	T upstream (circuit water) (°C)				
T return	0	10	20	30	40
T flow	(*)	(*)	(*)	35	(*)
T downstream (recycled air) (°C)					
22					
27					
32					
37					

(*) : The nominal flow rate for the upstream source obtained during the 30-35 °C test is retained for the tests at other upstream source temperatures.

A.5.3.8 Glycol water – recycled air HP

	T upstream (glycol water) (°C)				
T return	0	10	20	30	40
T flow	(*)	(*)	(*)	35	(*)
T downstream (recycled air) (°C)					
22					
27					
32					
37					

(*) : The nominal flow rate for the upstream source obtained during the 30-35 °C test is retained for the tests at other upstream source temperatures.

A.5.3.9 Extracted air – water HP

		T upstream (extracted air) (°C)				
		22	27	32	35	37
T downstream (water) (°C)						
T flow	T return (*)					
1,5	6,5					
7	12					
12,5	17,5					
18	23					
23,5	28,5					

(*) : For an upstream temperature of 35 °C. For any other source upstream temperature, the test is performed with the nominal flow rate obtained during the 35 °C test.

A.5.3.10 Ground - water HP

	T upstream (ground) (°C)
	30

T downstream (water) (°C)		
T flow	T return	
7	(*)	
18	(*)	

(*) : With the water flow rate determined in heating mode

A.5.4 Optional declaration of seasonal performances

For all heat pumps for which the applicant/holder wants to certify seasonal performances, he chooses one or two applications among:

- If the heat pump is declared as a "low temperature" heat pump: the application +35°C is mandatory
- Otherwise, if it is a "high temperature" heat pump: the application +55°C is mandatory, the application +35°C optional.

He chooses for each model 1 to 4 operating modes among possible settings on water:

- Fixed or variable water flow
- Fixed or variable water output temperature

The applicant/holder shall declare the RT 2012 pivot point, nominal point for $T_{upstream}$ = +7(6)°C for air/water heat pumps, 10_-7°C for water/water heat pumps, 0_-3°C for glycol water/water, +4°C for ground/water heat pumps.

Note: This point coincides with the nominal point of EN 14511, which is also necessary for the determination of the water flow as part of EN 14825 (this is therefore a key point during measuring points sampling, for each line).

Part load operating points correspond to those of a RT 2012 matrix only for "on-off" control devices, for which the water output flow and temperature are fixed (no water logic). The other heat pumps and operating mode are not concerned.

The applicant/holder shall declare for each chosen climate:

- The rated thermal input $P_{designh}$ which defines the thermal load at $T_{designh}$ that the product can fulfil.

Note: In our case, $P_{designh}$ is equal to $P_{rated,}$ $T_{designh}$, also known as P_{rated}

- Part load powers and COP at A, B, C and D point of the standard EN14825 (see §A.3)
- Bivalent temperature T_{biv}
- Limit operating temperature TOL

  Note: At cool climate, $T_{biv} \leq$ -7°C; at average climate $T_{biv} \leq$ +2°C and at hot climate $T_{biv} \leq$ +7°C

  At cool climate TOL ≤ -15°C; at average climate TOL ≤-7°C and at hot climate TOL = +2°C
- Power and COP at T_{biv}
- Power and COP at TOL. If $TOL_{declared}$ < -10°C, power and COP shall not be declared at TOL but at -10°C
- Auxiliary power P_{sb}, P_{to}, P_{off} and P_{ck}
- Power and COP on a cyclic interval P_{cych} and the degradation coefficient C_{dh} for each point for which the heat pump is in "on/off" mode? If Cd is not indicated, it is equal to the default value 0.9.

  Note: The influence of Cd on the SCOP global calculation is trivial compared to the tolerance on the SCOP
- Seasonal performances coefficient SCOP, active SCOPon and net SCOPnet
- Seasonal thermal efficiency ηs

A.5.5 Special characteristics of variable power regulation HPs

The manufacturer shall send the means for obtaining the minimum continuous operation load ratio from his product under evaluation ($LR_{contmin}$).

- $LR_{contmin}$ is only calculated for the matrix pivot point temperature conditions
- $LR_{contmin}$ is defined as the minimum continuous operation load ratio, i.e.:

  $LR_{contmin}$ = Minimum continuous operation load heating capacity / Heating capacity declared and/or measured under pivot point conditions

A heating capacity test at this load ratio is performed to verify the continuous operation of the HP (no cycling) and record the following performance values:

- The heating capacity measured in this way is compared to the heating capacity measured and/or declared at the same pivot point of the matrix and $LR_{contmin}$ is calculated.

  If the difference between the calculated value and the value of $LR_{contmin}$ declared by the manufacturer is less than 10% of the declared value, the value of $LR_{contmin}$ is then validated.
- if the value of LRcontmin is validated, the COP at $LR_{contmin}$ is measured and validated, $Ccp_{LRcontmin}$ is then calculated and validated, as follows.

  $Ccp_{LRcontmin}$ = COP at $LR_{contmin}$ / COP at pivot point

A.5.6 Share of electrical power for the auxiliaries

The electrical standby power (Psb) for the auxiliaries is measured with the appliance in standby mode according to the provisions of standard NF EN 14825. The share of the electrical power for the auxiliaries in the total electrical power (Ratio) is the ratio between the standby power and the absorbed power at pivot point.

A.5.7 Acoustic power level

If the seasonal performances option is chosen, the acoustic power shall be declared for the main chosen application (47_55°C or 30_35°C) at nominal point +7°C, necessarily at average climate and the other climates if applicable.

Sound power levels shall be determined under the conditions set out in Appendix AA (Part 10) of this certification standard. Outside the building, they must comply with the following thresholds:

Heating capacity P [kW]	Acoustic power at $P_{nonimal}$ Pnominal Lw [dB(A)]	For information only Rules 813/2013 thresholds Acoustic power level at the nominal thermal power L_{WA} [dB(A)]	
		Indoor	Outdoor
0 < P ≤ 6	≤ 70	60	65
6 < P ≤ 10		65	70
10 < P ≤ 12	≤ 73		
12 < P ≤ 20		70	78
20 < P ≤ 30	≤ 78		
30 < P ≤ 50		80	88
50 < P ≤ 70	No threshold defined		
70 < P ≤ 100		No threshold defined	

A.6. PERFORMANCES VERIFICATIONS

Thermal, acoustic and seasonal performances are verified by targeted tests.

For each type of heat pump, a cold start cycle is performed.

The tests program is defined by EUROVENT CERTITA CERTIFICATION in compliance with the following rules, by taking into account any specific justified requests from the applicant.

A.6.1 Determining the number of heat pumps to be tested

The selection of the number of products to be tested in a range is defined in § 3.1.3.2

For heat pump available in heating mode only and reversible mode, (one or several ranges according to a common or different trade mark):

- If the declared performances are identical for the two versions, only the reversible version is tested
- If the declared performances are different, each version is tested

For heat pumps which can be installed outdoor or indoor (two ranges):

- One product per range is tested if the pressure in the discharge duct is less than 25 Pa
- One product among the two ranges is tested if the pressure in the discharge duct is lower or equal to 25 Pa.

Until January 2015, in case of an admission application, for seasonal performances, a test of one device including the verification of the seasonal performances validate all models of its range, whatever the number of models of this range. Starting 2016, the regular rules will be applied.

Until the end of 2015, as part of controls, a test allow to check from 4 heat pump ranges with the same heat source already certified NF-Heat Pump in heating mode and, potentially in dual-mode. Starting 2016, one test allows to validate from 3 ranges of heat pump with the same heat source, already certified NF-Heat Pump in heating mode, and potentially in dual-mode.

As part of follow-up tests, the devices to be tested (dual-mode which have seasonal performance or no) are chosen by the certification body.

A.6.2 Choosing of the conditions of tests – matrix

The number of measures to be performed according to the type of heat pump to certify a matrix depends of the operating range (downstream and upstream temperatures) declared as follows:

- For air/water HPs: 3 points for a declared line and 1 point per additional line,
- For other HP types: 2 points for a declared line and 1 points per additional line.

Note: On a line, the number of points tested is limited by the number of declared points (an applicant/holder can certify only one point; as a consequent only this point will be tested)

Note: Once the number of points is determined, these points can be taken in any lines (or any columns)

Moreover,

- For some type of heat pumps, some of operating points are mandatory (for defining flow rates),
- The performances of the HP are tested according at the pivot point of the RT 2012 matrix if declared,
- Specific performance of variable regulation HPs are determined at one operating point at the pivot point conditions if declared,
- The share of electrical power for the auxiliaries is tested at an operating point, at the pivot point conditions if declared,

A.6.3 Choosing of the conditions of tests – seasonal performances

At average climate:

For a glycol water/water device, adjusted at fixed flow rate and temperature, only the nominal threshold is necessary, part load COP being determined by the calculation:

- 10_-7°C ou 0-(-3)°C (Nominal point of EN 14511)
- Auxiliary power among those 4 : P_{sb}, P_{to}, P_{off} and P_{ck}

At average climate

		30_35°C or 47_55°C			
Adjusting on water		Fixed flow T fixe	Variable flow T fixe	Fixed flow T variable	Variable flow T variable
Nominal condition	+7	Mandatory nominal point EN 14511			
E	TOL				
F	Tbiv				
A	-7				
B	+2				
C	+7				
D	+12				

For a given application (30_35°C or 47_55°C) and a given adjustment on water, the power and COP are tested at:

- +7°C (nominal conditions of EN 14511)
- F (T_{biv}) for the verification of the coherence with $P_{designh}$
- A point among A, B, C, D or E (TOL), that is different from F (T_{biv}). Note: T_{biv}≤+2°C and TOL≤7°C
- An auxiliary power among those four: P_{sb}, P_{to}, P_{off} and P_{ck}

When two application are declared, a different auxiliary power is tested per application (ex: P_{sb} at 30_35°C and P_{off} at 47_55°C).

For each additional setting on water, power and COP are added at:

- One point among A, B, C, D or E (TOL), that is different from F (T_{biv})

When hot climate is added, power and COP are added at:

- One point for each declared application. Note: T_{biv}≤+7°C and TOL=$T_{designh}$=+2°C

When cool climate is added, power and COP are added at:

- One point for each declared application among: T_{biv} or {TOL if TOL ≥ -20°C} or {TOL or 15°C if TOL < -20°C}
- Another point per declared application. Note : T_{biv}≤+7°C, TOL< -15°C and TOL=$T_{designh}$= -22°C

If the device is declared at cool climate, a starting test is included in the COP measurement at a ≤ -15°C.

A.6.4 Acoustic power

Acoustic powers are tested in the conditions defined in the annex AA (Part 10).

A.6.5 Special test conditions

For heat pumps with continuous variable capacity control (Inverter compressor or other type of power variation), the manufacturer must provide the laboratory with the corresponding setting procedure for obtaining the declared operating points.

During the different heating capacity measurement tests, the supply voltage frequencies and/or speeds are noted for compressors and fans and mentioned in the test report.

For HPs with air connections, the connection specifications defined for the sound tests (see Appendix AA) also apply to thermal tests, meaning use of the same connection ducts.

For a heat pump range that can be installed (as it is or with optional equipment) indoors or outdoors, in which the pressure in the discharge duct (towards the outside) is less than 25 Pa; the heating capacity measurement tests are conducted in the outdoor free air blowing configuration with a pressure equal to 0.

"Ground – ground, "water – ground" and "outdoor air – ground" heat pumps are not part of the field of application of a standard for the determination of the heating performance of heat pumps.

This exclusion is related to the test method which is very different from those described in the European standard and applicable for heat pumps using air and water as heat transfer fluids.

Pending the preparation and publication of a European standard for these special appliances (CEN TC113 WG10 work), specific test protocols are applied for the certification of these heat pumps with respect to the heat pump NF mark and are given in:

- Appendix BB, part 10 for ground-ground HPs,
- Appendix CC, part 10 for water-ground HPs,
- Appendix DD, part 10 for outdoor air-ground HPs.

A.6.6 Tolerances

The applicable tolerances on the declared values are defined as follows:

- +5% on the absorbed powers,
- -5%, for the heating capacities measured for water and the corresponding COP or EER,
- -5% for heating capacities for air measured in steady state by the room calorimeter method and the corresponding COP or EER,
- -10% for heating capacities for air measured in transient regime (defrosting cycles) by the room calorimeter method and the corresponding COP or EER,
- -10% for heating capacities for air measured by the enthalpy method for air and the corresponding COP or EER,
- -10%, for heating capacities and for ground-ground, air-ground and water-ground HPs and the corresponding COP or EER.
- +2dB(A) for acoustic power levels Lw
- -10% for $P_{designh}$ for water/air and ground/water
- -5% for $P_{designh}$ for other heat pumps
- -8% for SCOP, $SCOP_{net}$ and η_s

A.6.7 Validation or rerating

If the declared values comply with the measured values taking the applicable tolerances into account, they are validated.

A.6.7.1 Thermal performances

If the declared values do not comply with the measured values, they are reset to the measured values, corrected by the applicable tolerance.

In case of deviation on $P_{designh}$ and/or off-tolerance SCOP, all models of all the ranges covered by the test (see § A.6.1 related to sampling) of the updated deviation of the tolerance.

For RT 2012 matrices, for values corresponding to unmeasured points, the declared values are corrected by a value equal to the mean differences relative to the compliance thresholds; this mean is calculated solely from the non-compliant measured values (see example below).

Example of validation of declared values

Example: Air to Water HP – declared/measured powers, and differences

Air/water HP Comparison between declared and measured powers (kW)										
Downstream temperature (°C)		Upstream temperature (air side) (°C)								
T flow (°C)	T return (°C)	-7			2			7		
		Declared	Measured	Difference (%)	Declared	Measured	Difference (%)	Declared	Measured	Difference (%)
35	30	4,20	4,00	4,8	3,40			7,20	6,60	8,3
45	40	4,00	3,70	7,5	2,80	2,50	10,7	7,40		

Tolerance on Powers = 5%

Processing of values:

- Measured values compliant: 4 ,0 → validated value = declared value = 4.2
- Measured values non-compliant: validated value = measured value x 1.05
- Unmeasured values: validated value = Declared value corrected by the mean of the relative differences with respect to the compliance thresholds, mean calculated from non-compliant values only.
- Mean relative differences with respect to compliance thresholds: (3,3+2,5+5,7)/3= **3,8 %**

Example: Air to Water HP – corrected matrix

Downstream temperature (°C)		Upstream temperature (air side) (°C)								
T flow (°C)	T return (°C)	-7			2			7		
		Declared	Difference (%)	Validated	Declared	Difference (%)	Validated	Declared	Difference (%)	Validated
35	30	4,20	4,8	4,20	3,40		3,30	7,20	8,3	6,90
45	40	4,00	7,5	3,90	2,80	10,7	2,60	7,40		7,10

A.6.7.2 Acoustic performances

If the declared values do not comply with the measured values, they are reset to the measured values, corrected by the applicable tolerance.

If the measured sound power level of a product exceeds the declared level for the product by more than 2 dB(A), all the range values must be changed on the basis of the deviation observed on the tested product, between the declared sound power value and the test report result.

For multi-split heat pumps, if the measured sound power level of one or more combinations exceeds the declared level by more than 2 dB(A), the certification file will be presented to the Special Committee and the reduction to apply to all the combinations will be studied on a case-by-case basis, depending on the deviations observed and the number of combinations.

A.7 QUALITY CONTROL SPECIFICATIONS

The quality control provisions stated in § 2.3 of the reference apply for these products.

In addition, for these types of heat pumps and for the hydraulic circuit leak tests (§2.3.3.2.2), the manufacturer must conduct a leak test at at least 0.8 times the maximum rated pressure (Ps) to ensure the absence of leaks.

STANDARD SHEET 2: TECHNICAL DATA SHEET

⚠ For all certification application files, one sheet must completed for each heat pump (HP).

1- DEFINITION OF THE USE OF THE HP COVERED BY THE APPLICATION

☐ "Space heating" HP
- ☐ with "cooling" option
- ☐ with "seasonal performance" option

☐ "Swimming pool" HP
- ☐ with "cooling" option

2 – DESCRIPTION OF THE HEAT PUMP

Identification of products:

⚠ Be very precise in identifying the products below. These identifications will be restated word for word on the admission certificate.

Trademark	Name of the range (commercial brand)	References (designation) of models of the heating/ swimming pool HP	References (designation) for the single-splits or multi-splits: (if necessary, fill in per type (wall, bracket…) and each component (indoors units))	
			References	Types

Assembly unit(s):

⚠ To be filled in for each manufacturing site that produces machines covered by the application (packages, outdoor unit, indoor unit)

Corporate name and address of the fabrication plant and/or assembly plant	Type [Manufacturing of single and/or manufacturing of outdoor unit and/or manufacturing of indoor unit and/or assembly	References of the units	Sub-contractor [Yes/No]

Type of heat pump subject to the application : (tick the relevant box(es))

- ☐ Outdoor air/Recycled air HP – single-unit
  - ☐ ductless indoor installation
  - ☐ ducted indoor installation
  - ☐ ducted outdoor installation
- ☐ Exhaust air/Fresh air HP – single-unit
  - ☐ ducted indoor installation
  - ☐ ducted indoor suction
- ☐ Exhaust air/Water HP – single-unit
  - ☐ ducted indoor installation
  - ☐ ducted indoor suction
  - ☐ ducted indoor discharge
- ☐ Outdoor air/Recycled air HP – single-split
  - ☐ ductless
  - ☐ ducted
- ☐ Outdoor air/Recycled air HP - multi-split
  - ☐ ductless
  - ☐ ducted
- ☐ Outdoor air/Water HP – single-unit
  - ☐ ductless outdoor installation
  - ☐ ducted indoor installation
- ☐ Outdoor air/Water HP - split
  - ☐ ductless outdoor installation
  - ☐ ducted indoor installation
- ☐ Outdoor air/Ground HP – single-unit
  - ☐ ductless outdoor installation
  - ☐ ducted indoor installation
- ☐ Outdoor air/Ground HP – split
- ☐ Glycol water/Water HP – single unit
  - ☐ outdoor installation
  - ☐ indoor installation
- ☐ Glycol water/Water HP - split
- ☐ Glycol water/Glycol water HP – single-unit
  - ☐ outdoor installation
  - ☐ indoor installation
- ☐ Glycol water/Glycol water HP – split
- ☐ Ground water/Water HP – single-unit
  - ☐ outdoor installation
  - ☐ indoor installation
  - ☐ With barrier exchanger
  - ☐ Without barrier exchanger
- ☐ Ground water/Water HP – split
- ☐ Ground water/Recycled air HP – single-unit
- ☐ Ground water/Recycled air HP – split
- ☐ Ground water/Ground HP – single-unit
- ☐ Ground water/Ground HP – split
- ☐ Water circuit/Recycled air HP
  - ☐ ductless
  - ☐ ducted
- ☐ Ground/Ground HP
  - ☐ outdoor installation
  - ☐ indoor installation
- ☐ Ground/Water HP
  - ☐ outdoor installation
  - ☐ indoor installation

3 – INFORMATION ON THE HEAT PUMP AND/OR ITS VARIOUS SEPARATE COMPONENTS

- ✓ **HP installation site** (tick the relevant box) :

☐ Outdoors ☐ Indoors

Note, for splits and multi-splits: the components are considered to be separate by definition. One part outdoors and the other part indoors. Please specify the location if this is not the case.

- ✓ **Defrosting** (principle):

- ✓ **Regulation** (principle):

- ✓ **Setting condition** of the HP for the requested applications (for: Inverter, Expansion valve, Defrost, Other), if applicable:

Do settings require work by the applicant? ☐ YES ☐ NO

- ✓ **Variable power regulation HPs:** if applicable, description of means for obtaining the minimum continuous operation load ratio ($LR_{contmin}$)

- ✓ **Acoustic**: if applicable, specific installation conditions for the HP

- ✓ **Pressure on the air** for appliances with ducting: …… (give value)

✓ **Heat pump equipment** (tick the relevant box(es))

☐ Variable speed compressor (DC, Inverter, etc …)
☐ Multiple speed fan. Number: ……
☐ Variable speed fan
☐ Expansion valve with type (thermostatic, electronic, …)
☐ Exchanger cooling operation (free cooling)
☐ Heater
☐ Domestic hot water production included in the HP
☐ Other equipment or accessories:

If the equipment mentioned below is not installed on all the models, it must be subject to separate right of use applications. However, we invite you to contact EUROVENT CERTITA CERTIFICATION to confirm this.

☐ Reversible cycle cooling operation *(reversible heat pump)*
☐ Passive cooling mode operation
☐ Circulation pump for collectors
☐ Multiple speed circulation pump. Number: ……
☐ Variable speed pump

☐ Circulation pump for the heating circuit
☐ Multiple speed circulation pump. Number: ……
☐ Variable speed pump

☐ Accumulator (buffer tank)

✓ requested operating points:

Depending on the HP categories covered by the application (heating and reversible if appropriate, swimming pools), the requested operating points shall be detailed in the data and characteristics tables given in § 4 below.

✓ Starting point at -15°C:

For Outdoor Air – Water type heat pumps, an HP starting point must be carried out to validate the operating range. To enable the laboratory to conduct the test, we ask that you specify below the maximum water temperature, for an outdoor temperature of -15°C. This value will be restated on the NF mark admission decision for the range.

Maximum water temperature = …… °C

Specific information about "swimming pool" HPs (to be completed if covered by the application)

✓ **Water flow** in the swimming pool exchanger (*tick the relevant box*):

☐ Low flow (temperature condition 26 - 31°C - ΔT = 5°K)
☐ High flow (temperature condition 26 - 28°C - ΔT = 2°K)

✓ **Use** requested for Air/Swimming pool water type HPs (tick the relevant box).

☐ Seasonal use (2 test conditions: 7°C and 15°C Air)
☐ Year-round use (3 test conditions: 2°C, 7°C and 15°C Air)

4 – MAIN COMPONENTS OF THE HEAT PUMP

	HP no. 1		HP no. 2		HP no. ….	
	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2
Reference / model						
Liquid refrigerant						
Type						
Load (kg)						
Compressor						
Type (Piston, Scroll, etc.)						
Trade name						
Model						
Number						
Phase shift condenser						
Specifications						
Expansion device						
Type						
Manufacturer						
Model						
Liquid receiver						
Volume (in l)						

FOR OUTDOOR EXCHANGER - WATER (Fill in if covered)						
	HP no. 1		HP no. 2		HP no. ….	
	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2
Reference / model (only for separate components of the HP)						
Exchanger(s)						
Type						
Manufacturer						
Model						
Number						
Integrated pump "YES or NO"						
Manufacturer						
Model						
Number						
Set position (if several positions)						
Glycol water type and concentration						

FOR OUTDOOR EXCHANGER - AIR (Fill in if covered)						
	HP no. 1		HP no. 2		HP no. ….	
	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2
Reference / model (for separate components from the HP)						
Exchanger(s)						
Type						
Manufacturer						
Model						
Front area (m^2)						
Fins type/spacing (in mm)						
Fan(s)						
Type						
Number						
Trade name						
Rotation speed (rpm)						
Diameter of blades or turbine (mm)						
Number of blades/turbines						
Fan motor(s)						
Manufacturer						
Reference						

FOR OUTDOOR EXCHANGER (for Ground/Water or Ground/Ground type HP) - GROUND (Fill in if covered)						
	HP no. 1		HP no. 2		HP no. ….	
	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2
Crowns						
Type						
Manufacturer						
Model						
Number						
External diameter (in mm)						
Thickness (mm)						
Length of a crown (in m)						
Materials						

FOR INDOOR EXCHANGER - WATER (Fill in if covered)						
	HP no. 1		HP no. 2		HP no. ….	
	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2
Reference / model (for separate components from the HP)						
Exchanger						
Type						
Manufacturer						
Model						
Number						
Integrated pump "YES or NO"						
Manufacturer						
Model						
Number						
Set position (if several positions)						
Glycol water type and concentration						

FOR INDOOR EXCHANGER - AIR (Fill in if covered)						
	HP no. 1		HP no. 2		HP no. ….	
	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2
Reference / model (for separate components from the HP)						
Exchanger						
Type						
Manufacturer						
Model						
Front area (m^2)						
Fins type/spacing (in mm)						
Fan(s)						
Number						
Trade name						
Type						
Rotation speed (rpm)						
Diameter of blades or turbine (mm)						
Number of blades/turbines						
Motor						
Manufacturer						
Reference						

FOR INDOOR EXCHANGER (for Ground/Ground, Air/Ground type HP)) - GROUND (Fill in if covered)						
	HP no. 1		HP no. 2		HP no. ….	
	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2
Crowns						
Type						
Manufacturer						
Number						
External diameter (in mm)						
Length of a crown (in m)						
Thickness (mm)						
Materials						

FOR SWIMMING POOL EXCHANGER (Fill in if covered)						
	HP no. 1		HP no. 2		HP no. ….	
	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2	Circuit no. 1	Circuit no. 2
Reference / model (for separate components from the HP)						
Exchanger						
Type						
Manufacturer						
Model						
Number						
Integrated pump "YES or NO" (for heating + swimming pool exchanger HP)						
Manufacturer						
Model						
Number						
Set position (if several positions)						
Glycol water type and concentration						

5 – DATA AND CERTIFIED FEATURES FOR SINGLE UNITS AND SINGLE-SPLITS

⚠ For joint applications for "space heating" HPs AND "swimming pool" HPs, fill in the table below for each of the two functions.

Characteristics for heating applications	HP no. 1	HP no. 2	HP no. 3	HP no.....	HP no.....
Reference/Model of the heat pump or combination:					
- Reference of outdoor unit					
- Reference of indoor unit					
Nominal voltage (in V)					
Current type (~ 50 Hz or 3~ 50Hz or 3 N~50 Hz)					
If applicable Regulation changeover threshold $LR_{contmin}$					
Performance correction coefficient $Ccp_{Lrcontmin}$					
The share of electrical power for the auxiliaries Ratio					
Standby power (in W)					
Temperature conditions ….._…../….._…..°C					
Heating capacity (in kW)					
Absorbed power (in kW)					
COP (stated with 3 significant figures(*))					
Temperature conditions ….._…../….._…..°C					
Heating capacity (in kW)					
Absorbed power (in kW)					
COP (stated with 3 significant figures)					
Temperature conditions ….._…../….._…..°C					
Heating capacity (in kW)					
Absorbed power (in kW)					
COP (stated with 3 significant figures)					
Sound power (in dB(A), stated in $1/10^{th}$) under the temperature conditions →					

….._…../….._…..°C for: (see test diagrams)					
Outdoor side, noise radiated by the casing					
Outdoor side, global noise of openings					
Indoor side, noise radiated by the casing					
Indoor side, airborne noise in the suction ducts					
Indoor side, airborne noise in the discharge ducts					
Indoor side, airborne noise in the suction inlet and radiated noise by the casing					

(*) The ratio heating power/absorbed power is rounded up, with 3 significant figures: to 2 decimal places. Examples:

Heating Power [kW]	79.89	79.90	80.00	80.09	80.10	80.00	80.00	80.00	80.00
Absorbed power [kW]	20.00	20.00	20.00	20.00	20.00	20.03	20.02	19.98	19.97
COP	3.99	4.00	4.00	4.01	3.99	4.00	4.00	4.00	4.01

Characteristics for cooling applications	HP no. 1	HP no. 2	HP no. 3	HP no…..	HP no…..
Reference/Model of the heat pump or combination:					
- Reference of outdoor unit					
- Reference of indoor unit					
Nominal voltage (in V)					
Current type (~ 50 Hz or 3~ 50Hz or 3 N~50 Hz)					
Temperature conditions ….._…../….._…..°C					
Cooling capacity (in kW)					
Absorbed power (in kW)					
EER (stated with 3 significant figures)					
Temperature conditions ….._…../….._…..°C					
Cooling capacity (in kW)					
Absorbed power (in kW)					
EER (stated with 3 significant figures)					

Temperature conditions ….._…../…..._…..°C					
Cooling capacity (in kW)					
Absorbed power (in kW)					
EER (stated with 3 significant figures)					
Temperature conditions ….._…../…..._…..°C					
Cooling capacity (in kW)					
Absorbed power (in kW)					
EER (stated with 3 significant figures)					

The ratio heating power/absorbed power is rounded up, with 3 significant figures: to 2 decimal places (see the examples upon-mentioned)

6.1 – DATA AND CERTIFIED FEATURES FOR MULTISPLIT HEAT PUMPS

⚠ Applies to "space heating" HPs only. Use one chart for each outdoor unit, object of the application of the right of use

For the outdoor unit (O.U) (Use one table per outdoor unit which is subject to the right of use application)			
Reference/ Model	Nominal voltage (in V)	Current type (~ 50 Hz or 3~ 50Hz or 3 N~50 Hz)	**Sound power** (in dB(A), stated in $1/10^{th}$) Radiated noise (maximum)

Combinations by size of indoor units (I.U)	Ratio in % (OU power with those of IU in operation)	Heating capacity (in kW) at 7/6_20/15°C	Absorbed power (in kW) at 7/6_20/15°C	COP	Heating capacity (in kW) at -7/-8_20/15°C	Absorbed power (in kW) at -7/-8_20/15°C	COP
e.g.: A+A							
⇩							
to							
⇩							
D+E							
A+A+A							
⇩							
to							
⇩							
A+C+D							
A+A+A+A							
⇩							
to							
⇩							
B+B+B+C							

6.2 – CERTIFIED SOUND POWERS FOR MULTISPLIT HEAT PUMPS

⚠ The sound power tables (in dB(A), stated in 1/10th) need to be filled in for each type and for all models (see test diagrams in Part 10 of this reference).

Indoor unit – Wall-mounted	Sound power	
	Noise radiated by the casing	
Reference/ Model	Low speed (1)	High speed

Indoor unit - Bracket mounted	Sound power	
	Noise radiated by the casing	
Reference/ Model	Low speed *(1)*	High speed

Indoor unit – Ceiling-mounted	Sound power	
	Noise radiated by the casing	
Reference/ Model	Low speed *(1)*	High speed

Indoor unit – With duct At suction and discharge	Sound power	
	Airborne noise in the suction duct and noise radiated by the casing	
Reference/ Model	Low speed *(1)*	High speed

(1) Optional measurement. To be completed if the applicant / holder wants to certify the noise at low speed.

⚠ So that the laboratory can measure the sound power radiated by each indoor unit, the applicant must supply it with the procedure enabling operation in ventilation mode alone, without starting up the refrigeration circuit of the outdoor unit."

7- SEASONAL PERFORMANCES

⚠ Values are to be filled in for each application, with a chosen operating mode and climate

Seasonal performance	HP n°1	HP n°2	HP n°3	HP n°…	HP n°…
Reference / model of heat pump or combination:					
- Operating mode: water flow [fixed or variable]					
- Output water temperature [fixed or variable]					
Application 30_35°C or 47_55°C]					
Climate (cool, average or hot)					
Nominal thermal performance Prated [Kw]					
Seasonal performance coefficient SCOP [-]					
Net seasonal performance coefficient SCOP [-]					
Seasonal thermal efficiency η_s					

⚠ Values are to be filled in for selected models for tests

Model(s):	[information identifying the model(s) to which the information relates]		
Air-to-water heat pump:			[yes/no]
Water-to-water heat pump:			[yes/no]
Brine-to-water heat pump:			[yes/no]
Low-temperature heat pump:			[yes/no]
For low-temperature heat pumps, parameters shall be declared for low-temperature application. Otherwise, parameters shall be declared for medium-temperature application.			
Parameters shall be declared for average climate conditions.			

Item	Symbol	Value	Unit
Rated heat output (3) at Tdesignh = -10 (-11) °C	Prated = Pdesignh	x	kW
Active mode coef. of performance	$SCOP_{on}$	x,xx	–
Declared capacity for heating for part load at indoor temperature 20 °C and outdoor temperature Tj			
T_j = – 7 °C	Pdh	x,x	kW
T_j = + 2 °C	Pdh	x,x	kW
T_j = + 7 °C	Pdh	x,x	kW
T_j = + 12 °C	Pdh	x,x	kW
T_j = bivalent temperature	Pdh	x,x	kW
T_j = operation limit temperature	Pdh	x,x	kW
For air-to-water heat pumps: T_j = – 15 °C (if TOL < – 20 °C)	Pdh	x,x	kW
Bivalent temperature (maximum +2°C)	Tbiv	x	°C
Cycling interval capacity for heating at T_j = +7°C	Pcych	x,x	kW
Degradation coefficient (4) at T_j = +7°C	Cdh	x,x	—
Cycling interval capacity for heating at T_j = +12°C	Pcych	x,x	kW
Degradation coefficient (4) at T_j = +12°C	Cdh	x,x	—
Power consumption in modes other than active mode			
Off mode	P_{OFF}	x,xxx	kW
Thermostat-off mode	P_{TO}	x,xxx	kW
Standby mode	P_{SB}	x,xxx	kW
Crankcase heater mode	P_{CK}	x,xxx	kW
Other items			
Capacity control	fixed/variable		
Sound power level, indoors	L_{WA}	x	dB(A)
Sound power level, outdoors	L_{WA}	x	dB(A)
Contact details	Name and address of the manufacturer or its authorised representative.		

Item	Symbol	Value	Unit
Seasonal space heating energy efficiency	η_s	x	%
Seasonal coefficient of performance	SCOP	x,xx	–
Net seasonal coef. of performance	$SCOP_{net}$	x,xx	–
Declared coefficient of performance or primary energy ratio for part load at indoor temperature 20 °C and outdoor temperature Tj			
T_j = – 7 °C	COPd	x,xx	–
T_j = + 2 °C	COPd	x,xx	–
T_j = + 7 °C	COPd	x,xx	–
T_j = + 12 °C	COPd	x,xx	–
T_j = bivalent temperature	COPd	x,xx	–
T_j = operation limit temperature	COPd	x,xx	–
For air-to-water heat pumps: T_j = – 15 °C (if TOL < – 20 °C)	COPd	x,xx	–
For air-to-water HP : Operation limit temperature (maximum -7°C)	TOL	x	°C
Heating water operating limit temperature	WTOL	x	°C
Cycling interval efficiency at T_j = +7°C	COPcyc	x,xx	–
Cycling interval efficiency at T_j = +12°C	COPcyc	x,xx	–
Supplementary heater			
Rated heat output (3)	Psup = sup(Tj)		kW
Type of energy input			
Outdoor heat exchanger			
For air-to-water HP: Rated air flow rate	$Q_{airsource}$	x	m^3/h
For water-to-water: Rated water flow rate	or $Q_{watersource}$	x	m^3/h
For brine-to-water: Rated brine flow rate	or $Q_{brinesource}$	x	m^3/h

(3) For heat pump space heaters and heat pump combination heaters, the rated heat output Prated is equal to the design load for heating Pdesignh, and the rated heat output of a supplementary heater Psup is equal to the supplementary capacity for heating sup(Tj).

(4) If Cdh is not determined by measurement then the default degradation coefficient is Cdh = 0,9.

Legend
- Declared and certified
- Declared for the tested model

black	From 813/2013
gray	added to the fiche
	Not applicable

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CERTIFICATION REFERENCE
NF MARK – HEAT PUMP

PART 9
APPENDIX B
SPECIFIC REQUIREMENTS FOR SWIMMING POOL HPs

CONTENTS

Rev 8 – August 2014

B.1. APPLICABILITY

This part of the NF HP reference standard details specific provisions for electrically driven heat pumps used for heating swimming pool water for seasonal and/or annual use, installed outdoors or inside a building.

The certified characteristics are:

- The Coefficient of Performance (COP),
- The heating capacity,
- The absorbed electrical power,
- The acoustic power level.

The products covered are defined according to the following types:

- "outdoor air/swimming pool water" type,
- "(ground)water/swimming pool water" type,
- "glycol-water mix/swimming pool water" type,
- "ground/swimming pool water" type.

B.2. REFERENCE DOCUMENTS:

The documents mentioned in §2.2.2 are completed by the following:

- NF EN 14511-1 (October 2013): Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling
  - Part 1: - "Terms and definitions"
  - Part 2: - "Test conditions"
  - Part 3: - "Test methods".
  - Part 4: - "Requirements"

  Note: Swimming pool heat pumps do not fall within the scope of standard EN 14511; however, it is used to determine the performance of the appliance.

- NF EN 15879-1 (April 2011): Testing and rating of direct exchange ground coupled heat pumps with electrically driven compressors for space heating and/or cooling - Part 1: Direct exchange-to-water heat pumps.

B.3. DEFINITION OF SYSTEMS AND RANGES

A heat pump range comprises products with the same components, namely:

- same refrigeration process (for example, number of compressors or stages, etc.)
- same refrigerant
- same compressor type
- same expansion valve type
- same evaporator type
- same condenser type
- same defrost principle (4-way valve or vapour injector)
- same power regulation principle (refrigerant performance management)
- same swimming pool exchanger type

Special cases:

- For technological reasons, it can prove necessary to change compressor technology within a range. One or two products may therefore be added.
- A single product that exists with single-phase and three-phase power supply constitutes two models in the same range. In this case, it must be possible to distinguish between them by their names.
- For heat pumps that can be installed (as they are or with optional equipment) indoors or outdoors, these will be viewed as two product ranges but a single heating capacity measurement will be carried out if the pressure in the duct is less than 25 Pa and two heating capacity measurements will be carried out if the pressure in the duct is greater than 25 Pa (see special test conditions in § A.4.1)
- For a range of appliances offering options incorporated into the heat pump, these constitute different ranges if such options have an impact on the certified features of the heat pump. In this case, the applicant shall complete separate applications for the right to use the NF mark.

B.4. TECHNICAL SPECIFICATIONS AND CHARACTERISATION METHODS

Principles:

- The thermal and acoustic performance declarations are verified by tests,
- COP thresholds are set,
- Acoustic power thresholds are set for certain HP heating capacity levels,
- For certain HP types, tests for suitability for this function are performed (hot and cold starts).

Test programme:

The test programme is defined according to the HP type and the seasonal or annual use in the tables below. The selection of the number of products to be tested in a range is defined in § 3.1.3.2.

Conditions for validation of declared values for heating capacities:
If the declared values comply with the measured values taking the applicable tolerances into account, they are validated.
The applicable tolerances on the declared values are defined as follows:

- 5% for low water flow HPs; (ΔT = 5 K),
- 10% for high water flow HPs; (ΔT = 2 K).

If the declared values do not comply with the measured values, they are reset to the measured values, corrected by the applicable tolerance.

Special test conditions:
For heat pumps with continuous variable capacity control (inverter compressor or other type of power variation), the manufacturer must provide the laboratory with the corresponding setting procedure for obtaining the declared operating points.
During the different heating capacity measurement tests, the supply voltage frequencies and/or speeds are noted for compressors and fans and mentioned in the test report.

For a heat pump range that can be installed (as it is or with optional equipment) indoors or outdoors, in which the pressure in the discharge duct (towards the outside) is less than 25 Pa; the heating capacity measurement tests are conducted in the outdoor free air blowing configuration with a pressure equal to 0.

B.4.1 Energy performance in heating mode

The energy performance in heating mode, meaning the heating capacity, the absorbed electrical power and the COP, must be determined under the conditions below. COP thresholds are defined and must be respected.

B.4.1.1 Outdoor air – swimming pool water

✓ ***Application for seasonal use***

Low water flow heat pumps (ΔT = 5°C)				
Evaporator		Swimming pool heating system		Min. COP
Dry bulb temperature (°C)	Wet bulb temperature (°C)	Water inlet temperature (°C)	Water outlet temperature (°C)	
15	12	26	31	4,20
7	6	26	*	3,40

(*) The test is performed with the water flow rate determined during the test at +15 °C.

High water flow heat pumps (ΔT = 2)				
Evaporator		Swimming pool heating system		Min. COP
Dry bulb temperature (°C)	Wet bulb temperature (°C)	Water inlet temperature (°C)	Water outlet temperature (°C)	
15	12	26	28	4,20
7	6	26	*	3,40

(*) The test is performed with the water flow rate determined during the test at +15 °C.

A test for suitability for the function must be performed, on one of the appliances selected for determination of thermal performance (see § 3.1.3.2), under the conditions defined below:

- Minimum air temperature 7(6)°C with a minimum water temperature of 12°C
- Maximum air temperature 30(20)°C with maximum water temperature 26°C

For both these conditions, the machine must start and operate for 20 minutes.

✓ *Application for year-round use*

Low water flow heat pumps (ΔT = 5°C)				
Evaporator		Swimming pool heating system		Min. COP
Dry bulb temperature (°C)	Wet bulb temperature (°C)	Water inlet temperature (°C)	Water outlet temperature (°C)	
15	12	26	*	4,20
7	6	26	31	3,40
2	1	26	*	2,70

(*) The test is performed with the water flow rate determined during the test at +7 .

High water flow heat pumps (ΔT = 2)				
Evaporator		Swimming pool heating system		Min. COP
Dry bulb temperature (°C)	Wet bulb temperature (°C)	Water inlet temperature (°C)	Water outlet temperature (°C)	
15	12	26	*	4,20
7	6	26	28	3,40
2	1	26	*	2,70

(*) The test is performed with the water flow rate determined during the test at +7 .

A test for suitability for the function must be performed, on one of the appliances selected for determination of thermal performance (see § 3.1.3.2), under the conditions defined below:

- Minimum air temperature 2(1)°C with a minimum water temperature of 12°C
- Maximum air temperature 30(20)°C with maximum water temperature 26°C

For both these conditions, the machine must start and operate for 20 minutes.

B.4.1.2 (Ground) water – swimming pool water

Low water flow heat pumps (ΔT = 5°C)				
Evaporator		**Swimming pool heating system**		**Min. COP**
Water inlet temperature (°C)	Water outlet temperature (°C)	Water inlet temperature (°C)	Water outlet temperature (°C)	
10	7	26	31	4,50

High water flow heat pumps (ΔT = 2)				
Evaporator		**Swimming pool heating system**		**Min. COP**
Water inlet temperature (°C)	Water outlet temperature (°C)	Water inlet temperature (°C)	Water outlet temperature (°C)	
10	7	26	28	4,50

B.4.1.3. Glycol-water mix-to-swimming pool water

Low water flow heat pumps (ΔT = 5°C)				
Evaporator		**Swimming pool heating system**		**Min. COP**
Water inlet temperature (°C)	Water outlet temperature (°C)	Water inlet temperature (°C)	Water outlet temperature (°C)	
0	-3	26	31	3,60

High water flow heat pumps (ΔT = 2)				
Evaporator		**Swimming pool heating system**		**Min. COP**
Water inlet temperature (°C)	Water outlet temperature (°C)	Water inlet temperature (°C)	Water outlet temperature (°C)	
0	-3	26	28	3,60

B.4.1.4. Ground-to-swimming pool water

Low water flow heat pumps (ΔT = 5°C)			
Evaporator	Swimming pool heating system		Min. COP
Evaporating temperature (°C)	Water inlet temperature (°C)	Water outlet temperature (°C)	
-5	26	31	3,40

High water flow heat pumps (ΔT = 2°C)			
Evaporator	Swimming pool heating system		Min. COP
Evaporating temperature (°C)	Water inlet temperature (°C)	Water outlet temperature (°C)	
-5	26	28	3,40

B.4.3 Acoustic power level

Sound power levels shall be determined under the conditions set out in Appendix AA (Part 10) of this certification standard. Outside the building, they must comply with the following thresholds:

Heating capacity [in kW]	Sound power [in dB(A)]
0 < capacity ≤ 10	≤ 70
10 < capacity ≤ 20	≤ 73
20 < capacity ≤ 50	≤ 78
50 < capacity ≤ 100	No threshold defined

If the measured sound power level of a product exceeds the declared level for the product by more than 2 dB(A), all the range values must be changed on the basis of the deviation observed on the tested product, between the declared sound power value and the test report result.

For multi-split heat pumps, if the measured sound power level of one or more combinations exceeds the declared level by more than 2 dB(A), the certification file will be presented to the Special Committee and the reduction to apply to all the combinations will be studied on a case-by-case basis, depending on the deviations observed and the number of combinations.

B.5. QUALITY CONTROL SPECIFICATIONS

The quality control provisions stated in § 2.3 of the reference apply for these products.

In addition, for these types of heat pumps and in respect of:

- hydraulic circuit leak tests (§2.3.3.2.2), the manufacturer shall perform a leak test at at least 1.3 times the maximum permissible pressure (Ps) to ensure that there are no leaks,
- documentation control (§2.3.3..3.3): the general conditions of sale must show the guarantee against corrosion (of 5 years) for the swimming pool exchanger and all parts in contact with the swimming pool water. This provision must be verified and be subject to a record.
- For swimming pool heat pumps for which the NF mark has been obtained with an additional exchanger, the holder shall include in the installation and user manual a copy of the certificate of right of use of the NF mark, identifying the exchanger.
- If appropriate, the installation and user manual must state that the product is intended for seasonal use.

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CERTIFICATION REFERENCE
HEAT PUMP – NF MARK

PART 9
APPENDIX C
SPECIFIC REQUIREMENTS FOR DUAL-MODE HPs

CONTENTS

Rev 8 – August 2014

C.1. APPLICABILITY

This part of the NF HP reference standard details specific provisions for "dual-mode" electrically driven heat pumps, i.e. intended for space heating and domestic hot water production.

The products covered are characterised by their operating mode and include:

- Simultaneous operation HPs, i.e. appliances capable of simultaneously carrying out space heating or cooling and domestic hot water production,
- Alternating operation HPs, which perform each of the two functions in alternation and are not suitable for simultaneous operation.

The heat pumps covered by the scope are defined in the Annex A.

C.2. CERTIFIED PERFORMANCES

The certified performances are:

- For simultaneous operation HPs:
  - the temperature stabilisation time (t_h),
  - the spare capacity (Pes),
  - the global performance coefficient for a given tapping cycle (COP_{global}).
  - the reference hot water temperature (θ'_{WH}),
  - the maximum effective hot water volume (V_{MAX}),

Note: The global performance coefficient is defined as the ratio of the total effective energy for the heating and domestic hot water (DHW) functions to the total energy absorbed for both functions carried out simultaneously.

- For alternating operation HPs:
  - the temperature stabilisation time (t_h),
  - the spare capacity (Pes),
  - the performance coefficient in DHW production mode (COP_{DHW}) for a given tapping cycle.
  - the reference hot water temperature (θ'_{WH}),
  - the maximum effective hot water volume (V_{MAX}),

C.3. REFERENCE DOCUMENTS:

The documents mentioned in § 2.2.2 are completed by the following:

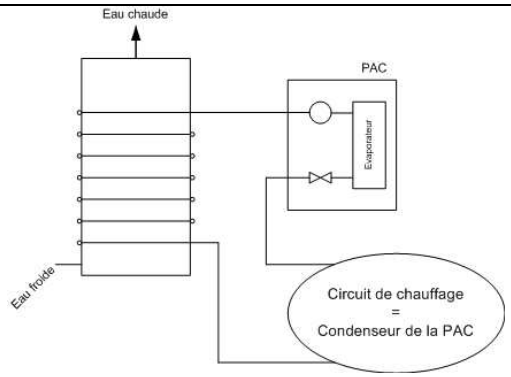
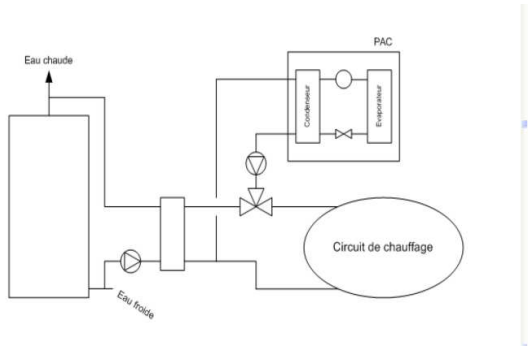
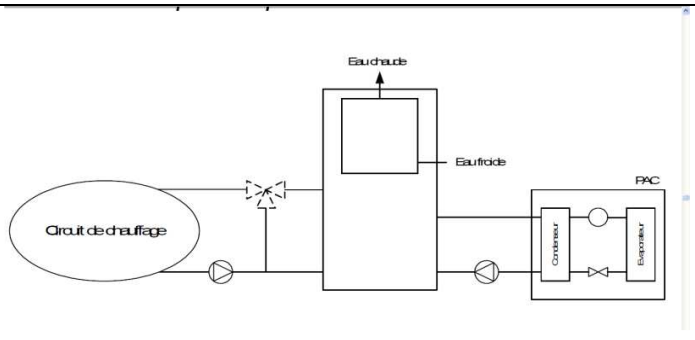
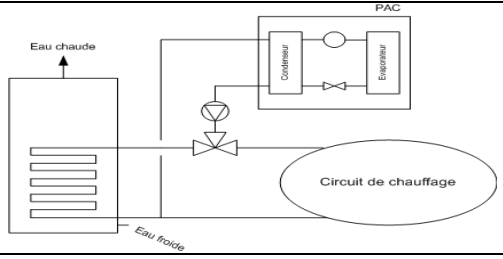
- NF EN 16147 (March 2011) – Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors. Testing and requirements for marking of domestic hot water units.
- NF EN 15332 (February 2008) – Heating boilers – Energy assessment of hot water storage systems.
- NF EN 14511 (October 2013) Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling
  - Part 1 "Terms and definitions"
  - Part 2 "Test conditions"
  - Part 3 "Test methods"
- NF EN 15879-1 (April 2011): Testing and rating of direct exchange ground coupled heat pumps with electrically driven compressors for space heating and/or cooling - Part 1: Direct exchange-to-water heat pumps.

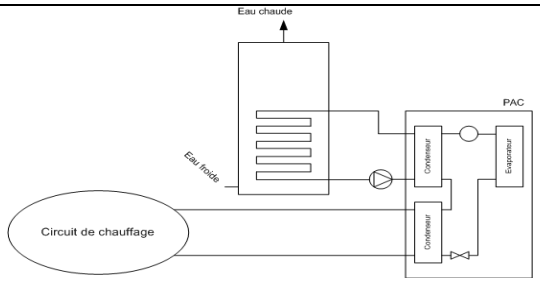
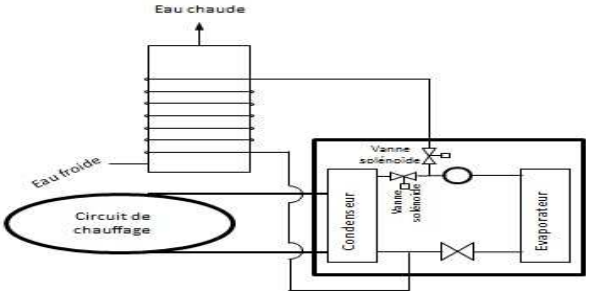
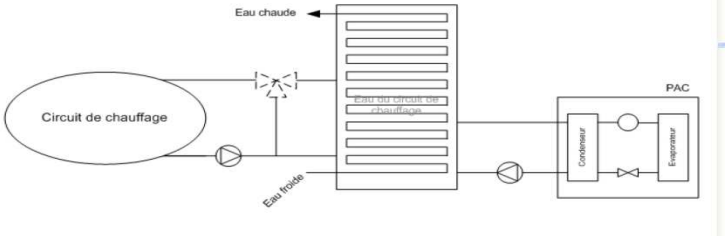
C.4. DEFINITION OF SYSTEMS AND RANGES:

C.4.1 Dual mode heap pump

The list of the main systems covered is given in the table below. Other types of systems may be certified, but should undergo an assessment by CERTITA prior to the application.

Chart C.1: Nomenclature of most covered systems

Dual-mode HP type		System components	*Sample* block diagram
1	Simultaneous operation HP with desuperheater	. HP with desuperheater separate from condenser . Storage tank incorporating desuperheater . Condenser connected to heating circuit	
2	2.Alternating operation HP with intermediate exchanger	. HP . Intermediate exchanger . Storage tank . Circulator pump(s) . 3-way valve	
3	. A. Alternating operation HP with water bath exchanger B. Simultaneous operation HP with water bath exchanger	. HP . Water bath exchanger . Storage tank . Circulator pump(s) . 3-way valve	
4	Alternating operation HP with integrated coil or double-jacket exchanger	. HP . Storage tank incorporating exchanger . Circulation pump . 3-way valve	

Dual-mode HP type		System components	*Sample* Block diagram
5.	Alternating operation HP with dual condenser and DHW exchanger	. Dual-condenser HP . Storage tank incorporating exchanger . Circulator pump(s)	
6.	Alternating operation HP with dual condenser without DHW exchanger	. Dual-condenser HP . Storage tank incorporating one of the condensers . with or without Circulation pump	
7.	A. Alternating operation HP B. Simultaneous operation HP	. HP . Storage tank incorporating exchanger for instant DHW production . Circulation pump . 3-way valve	

C.4.1.1 Simultaneous operation dual-mode HP:

A simultaneous operation dual-mode heat pump is a system composed of:

- a heat pump,
- a storage tank (incorporating an exchanger if applicable),
- a control system,
- accessories.

C.4.1.2 Alternating operation dual-mode HP:

An alternating operation dual mode HP is a system composed of:

- A heat pump,
- a storage tank,
- a control system,
- if applicable, hydraulic circuit switching component (e.g. 3-way valve),
- one or more circulation pump(s), if applicable,
- if applicable, an intermediate exchanger,
- accessories.

C.4.2 Tank ranges

A range of tanks is a set of tanks which the following elements are identical:

- heat losses: the ratio of the static losses to the tank volume (to be supported by the manufacturer) does not differ by more than 40%,
- position (horizontal or vertical),
- geometry (cylindrical, spherical),
- if applicable, relative position and type (low, high or middle) of the exchanger and the electrical reserve.

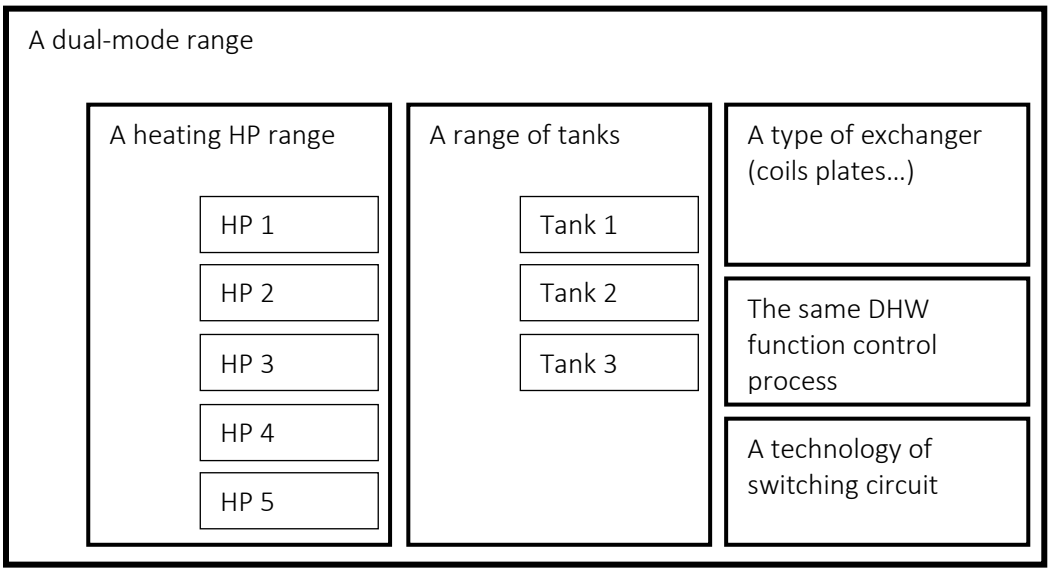
For some special cases in which these provisions are unsuitable, special provisions may be defined a case-by-case basis.

C.4.3 Range of dual-mode HP

A simultaneous operation dual-mode HP range is a set of systems solely comprising:

- HPs belonging to the same range according to the definition of HPs for space heating (Appendix A),
- the same tank model, i.e. for which the following items are identical (see C.4.2):
- the same exchanger model, i.e. for which the following items are identical technology: (plates, coils, etc)
- the same DHW function control process.
- same technology of hydraulic or refrigerating circuit switching component, if applicable (for alternating operation dual-mode HP

Figure C.1 Schematic representation of dual-mode heat pump range



C.5. TECHNICAL SPECIFICATIONS AND CHARACTERISATION METHODS

C.5.1. Principles

The HPs used as constituent parts of the dual-mode HP system must be NF Heating HP-certified.

The performances mentioned in § C.1 above and determined according to § C.4.2 below must comply with the values declared by the applicant or holder (corresponding to the declared set-point temperature and tapping cycle).

Multiple set-point temperatures and/or tapping cycles may be declared by the applicant or holder.

Several ranges of alternating dual-mode HP can be grouped whichever the holder/applicant chooses, in the basis of:

- A group of HP range which have the same upstream heat source (ex: air, water, ground… where water and glycol water are integrated)
- Same range of tanks (see § C.4.2)
- Same DHW function control process (position of the sensor, hysteresis of the sensor, working of off-peak time…
- Same technology of DWH exchanger (coils, plates…)
- Same HP output power (fixed or variable)
- Same maximum heating upsteam temperature

Performance declarations for the DHW function are checked by means of tests and/or simulations.

The performances of the ranges are determined (see C.4.3.) by at least 1 test of the DHW function on one model for an adjusted temperature and a declared taping cycle and by simulation for the other models.

In the case of one of this point is different, an adding tests on another model has to be performed.

Note: if the technology circuit switching component is different, no adding tests have to be performed.

For an admission, the applicant chooses a product(s) which will be tested by making sure to pick a mid-range product (power and volume of the tank). We advise the applicant to contact EUROVENT CERTITA CERTIFICATION to validate the model which will be tested.

The HPs which have to be tested must be provided with:

- the technical data sheet (§9.1 of NF EN 16147)
- instructions in respect of installation and maintenance in particular (§9.2 of NF EN 16147)
- connection component if there are specific

C.5.2. Characterization methods simultaneous operation HP – Tests

Performances are characterized by tests which follow the following criteria:

The HP is set to stabilized heating mode operation according to the provisions defined in the NF standard for the corresponding HP types for space heating.

Once stable operation has been achieved, DHW tapping is carried out according to the cycle described by the NF EN 16147 standard and specified by the manufacturer. The upstream and set-point temperatures are specified by the applicant or manufacturer.

The condenser return temperature is set to 30 ±1°C.

The test protocol is as follows:

- HP installation according to manufacturer recommendations
- Filling of tank with cold water at 10°C
- Manually shunting of solenoid switch valve to DHW (no temperature rise activation)
- Test condition settings in heating mode (e.g. for Ground water: 10-7°C, Floor heating water: 30-35°C)
- Measurements and results as per EN 14511 or EN 15879 (heating mode): Thermal power, $COP_{heating}$
- Switching of the solenoid for the DHW mode
- Measurements and results as per EN 16147: Temperature stabilization time, Spare capacity, Maximum hot water volume, Reference hot water temperature and COP_{global} calculation

C.5.3 Characterization methods alternate operation HP

C.5.3.1 Tests

The HP tests for DHW mode are conducted as per the EN 16147 standard with the following additional instructions.

Installation:
The manufacturer must provide all the components of the dual-mode HP, i.e.:

- The heat pump
- The tank
- The exchanger, if applicable
- The 3-way heating / DHW switching valve
- The DHW circuit circulation pump
- Lengths of pipes connecting the various components, with their insulation and end connections.
- An electrical auxiliary for DHW function, if applicable

The set shall be set up according to the manufacturer's instructions in the climatic chambers suitable for maintaining the environmental conditions defined in the EN 16147 standard.

The HP shall not be connected to a fictitious heating circuit; therefore, these connections shall be sealed and the manufacturer must envisage an operating procedure for the HP under these specific conditions.

Such a procedure may consist of set a water set-point temperature on the floor such that the heating / cooling mode is not activated.

Instrumentation

The intermediate water circuit(s) between the HP and the exchanger (and/or the tank) include(s) no temperature or water flow rate instrumentation.

Commissioning and tests:

To be able to control the DHW test bench handling the test sequence, retrieval of a binary signal (e.g. 0-10C) from the tank DHW request is necessary.
The manufacturer should provide the laboratory with the option of retrieving this signal.

C.5.3.2 Simulation

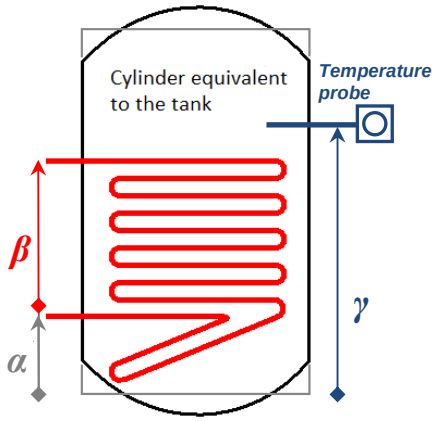
Limit of the simulation tool

Considering that validations were made on the simulation tool:

- Dual-mode HPs which require starting its auxiliary in order to reach its performance cannot be simulated,
- Simulation of performances are determinate apart from off-peak option,
- Tanks which can be simulated have volumes between 150 l and 400 l in volume water stored
- For each model of simulated dual-mode HP, the exchanger must have a minimal area, function of the heating power available for DHW of 0,25 m²/kW for coil-type exchanger and, 0,025 m²/kW for plates-types exchanger.

Input data of simulation

Figure C.2 Cylinder equivalent to the tank and fraction α, β and γ



For each model which performances are simulated, the manufacture has to declare the following data:

- Volume of the tank (V_n in l)
- Volume of useful water reserve of the tank (V_e in l), by default V_e=0,95xV_n
- Inner diameter of the tank (D en m)
- Total empty mass of the tank (M_{ballon} en kg)
- Area of the exchanger (S_{Ech} en m²)
- Mass of the exchanger (M_{Ech} en kg)
- Ratio which gives the position of the low point of the exchanger (see picture) compared to the low point of the cylinder equivalent to the storage tank (α, value between 0 and 1),
- Ratio which gives the size of the exchanger located above the low point of the exchanger compared to the whole exchanger (β, value between 0 and 1)
- Adjusted temperature of the tank (in T_c in C°, appears in the certificate)
- Position of the temperature probe in the tank: half-superior or half-inferior
- Ratio which gives the position the temperature probe compared to the low point of the cylinder equivalent to the storage tank (γ, value between 0 and 1)
- Hysteresis of the temperature probe of the tank (T_{Hyst} en °C)
- Average temperature of water of the tank in steady speed in zone 1- α (T_{cuve} en °C, used for the simulation),
- The share of heating capacity available for DHW for each certified point below, if different from the heating capacity in heating mode (P in kW)
- Tapping cycles to be simulated,

Moreover, a test report made by an independent laboratory accredited ISO 17025 must justified the following data:

- Ratio of the static heat loss of the storage tank in compliance with the standard NF EN 15332 (Q_{pr}, in Wh per 24h for a difference of temperature of 45°C)
  Note: In the standard, Q_{pr} is also known as Q_b

To finish, the following data have to be certified in heating mode for each model of the range of heating HP:

- Standby power (P_{sb}, in W)
- Characteristics at operating point of the upstream temperature corresponding to the requirement of the standard NF EN 16147 (i.e. 7°C for outdoor air / water) and at the following downstream temperatures:
  - 30_35°C
  - 40_45°C
  - 47_55°C if the maximal adjusted temperature (Tcmax) is higher or equal to 55°C
- At Tcmax with a Δt de 5K if the maximal adjusted temperature is lower than 55°C (i.e. 49_54°C).

Simulated performances

Temperature stabilisation time (th)

$$t_h = \frac{[(1-\alpha)\times[4{,}2\times V_n + 4{,}25\times(M_{Ballon} - M_{Ech})] + \beta\times 0{,}38\times M_{Ech}]\times(T_{Cuve} - 10)}{3600\times(P_{DMT} - 0{,}5\times 0{,}001\times P_P)}$$

With:

- P_{DMT} (in kW), the average of certified heating capacities at 30/35 and 40/45
- P_P (in W), necessary heating capacity to compensate the static heat losses of the storage tank (here, 20 is the room temperature):

$$P_P = \frac{V_n \times K_R \times (T_{Cuve} - 0{,}5\times T_{Hyst} - 20)}{24}$$

With a steady cool rate K_{R1} in Wh/(24.l.K) (For a Q_{PR} in Wh/24h with a Δt of 45°C):

The spare capacity (Pes)

$$P_{es}(n) = \left[1 + r_0 \times \frac{D^2}{V_n^{2/3}} \times \exp(-0{,}225 \times (n-1))\right] \times P_{es}(\infty)$$

With:

- n, number of the operating cycle of the HP during phase P2
- r_0 = 175 (no unit)
- P_{es} (∞) heat losses of the storage tank in steady speed, data given by the following formula (where f_c is the "part of the heat surface of the tank")

$$P_{es}(\infty) = f_C \times \frac{P_P}{COP_{PES}} \qquad \text{with} \qquad f_C = \frac{1 + (1-\alpha) \times \frac{16 \times 0{,}001 \times V_n}{\pi \times D^3}}{2 + \frac{16 \times 0{,}001 \times V_n}{\pi \times D^3}}$$

and, with the COP_{PES}, the COP interpolate with the temperature of the storage tank (T_{Cuve}) lowered of half the value of the hysteresis (T_{HYST})

If the first simulated cycle lasts more 48 hours:

$$P_{es} = P_{es}(1) + P_{SB}$$

If there are several simulated cycles during 48 hours, the cycle n which does not exceed 48h is taken into consideration

$$P_{es} = P_{es}(n) + P_{SB}$$

Note: the user has to give the number of cycles, but, during the comparison model/experience, the value n=2 gave good results in all the cases handled: this value will be the default value.

Coefficient of performance in DHW production mode (COP_{DHW}):

$$COP_{DHW} = COP_{TAP} \times \frac{E_{TAP}}{E_{TAP} + E_P + 0{,}024 \times COP_{TAP} \times P_{SB}}$$

With COP_{TAP}, COP of the heat pump during the drawing cycle, considered equal to:

- 0,5 x (COP(40-45) + COP(47-55)) for XL cycles,
- COP (47-55) ou COP ((Tcmax – 5°C)-Tcmax) for L cycles and inferior,

- E_{Tap}, energy of the drawing cycle (in kWh)
- E_P, energy of static losses during the drawing cycle (in kWh)
- $P_{SB,}$ the standby power (electrical power, in W)

Energy of static losses E_P is equal to E_P = 0.024 x P_P is the power of static losses defined in this document.

Reference hot water temperature (θ'_{WH}, in °C)

$$\theta'_{WH} = \frac{V_1 \times T_{Cuve} + V_2 \times 40}{V_1 + V_2} + \delta T$$

With:

$V_1 = (1-\alpha) \times V_e$

$V_2 = 0$ if the restart of the HP is not allowed.

$t_0(s) = A \times (T_{Cuve} - 10) + 60 \times (1-\gamma) \times V_e/10 - \tau$

If the probe is located in the half superior of the storage tank, so A is taken at 15 s/°C. if the probe is located in the half inferior, A is taken at 0.

$$V_2 = P_{VMAX} \times \frac{t_0}{4{,}185 * 30}$$

P_{VMAX} is the absorbed power at the point 47-55 (in kW)

τ is the period of the start of the HP (time during which the power is insignificant)

$\delta T = 0$ if the restart of the HP is not allowed

$$\delta T = \frac{(1-\alpha) \times 0{,}45 \times M_{Ballon} \times (T_{Cuve} - 40)}{4{,}185 \times (V_1 + V_2)}$$ if the restart of the HP is allowed

Maximum effective hot water volume VMAX (l)

$$V_{MAX} = \frac{V_1 \times (T_{Cuve} - 10) + 30 \times V_2}{30}$$

Example of simulation
The following chart gives an example of final results by using the formulas.

Chart C.3 Results of the simulation

Cases		1(L)	1(M)	2	3
Machines description data					
Declared volume of the tank (liter)	V_n		200	200	300
Volume in water of the tank (liter)	V_e		190	190	285
Inner diameter of the tank (m)	D		0.43	0.5	0.55
Total empty weight of the rank (kg)	M_{Ballon}		135	108	168
108Mass of the exchanger (kg)	M_{Ech}		20	20	20
Coe20fficient of static heat loss (Wh per 24h per 45°C)	Q_{PR}		3500	3500	2750
Alpha fraction (low position of the exchanger)	α		0.25	0.25	0.25
Beta fraction (ratio of the exchanger)	β		0.85	0.94	0.85
Gamma fraction (position of the restart probe)	γ		0.69	0.77	0.666
Probe is up? YES = 1; NO = 0	-		1	1	1
Restart of the HP in phase P4? YES = 1	-		1	1	1
Declared adjusted temperature (°C)	T_C		55	55	55
Average genuine temperature (°C)	T_{Cuve}		55.2	55	56.2
Hysteresis (°C)	T_{Hyst}		5	5	10
Standby power (W)	P_{SB}		12	18	11
Drawing data					
Energy of drawing cycle	-	L	M	XL	L
Energy of drawing cycle E_{TAP} (kWh)	E_{TAP}	11.65	8.845	19.07	11.65
Power and COP data (Phases A, B, C, D according to EN 16147					
Average power in phase A (kW)	P_{DMT}		4.82	6	6.14
Average COP in phase B (-)	COP_{Pes}		2.11	2.11	2.17
Average COP in phase C(-) according to drawing	COP_{TAP}	2.54	2.11	2.98	2.4
Average power in phase D (kW)	P_{VMAX}		5	5.61	5.5
Simulation data					
Temperature stabilization time (hours)	t_h		2.64	1.94	2.99
Spare capacity (W)	P_{es}		75.0	89	61.3
Number of cycle	n		2	2	2
Coefficient of performance in DHW production mode	COP_{DHW}	1.98	1.63	2.14	1.97
Reference hot water temperature (°C)	θ'_{WH}		53.13	52.93	54.02
Maximum effective hot water volume (liter)	V_{MAX}		249.8	250.0	378.0
Temporary checking data					
Cooling constant (Wh/24h.l.k)	K_R		0.388	0.388	0.204
Power of static losses (W)	P_P		105.1	105.1	79.1
Fraction of hot area of the tank (-)	f_c		0.716	0.701	0.705
Drawn volume V1 (liter)	V1		142.5	142.5	213.8
Drawn volume V2 (liter)	V2		35.1	35.3	48.8
Delta of temperature (°C)	δt		0.93	0.74	0.84

C.5.4 Conditions for validation of declared values

C.5.4.1 Tests

The applicable tolerances on the declared values are defined as follows:

- 20 min for temperature stabilization times (th),
- 10% for spare capacities (P_{es}),
- 10% for performance coefficients in DHW production mode (COP_{DHW} and COP_{global}) for a given tapping cycle.
- - 1 K for reference hot water temperatures (θ'_{WH}),
- - 10% for maximum effective hot water volumes according to (V_{MAX}),

If the declared values comply with the measured values taking the applicable tolerances into account, they are validated.

For the tested machines, if the declared values do not comply with the measured values, they are reset to the measured values, corrected by the applicable tolerance (see example below).

We apply the declared values of the others models of the range the observed deviation, corrected by the applicable tolerance.

Examples:

	Tested machine	Non tested machine	Tested machine	Non tested machine	Tested machine	Non tested machine
Performance	th		COP_{DHW}		P_{es}	
Declared	1h00	2h00	2.50	2.20	10	12
Measured	1h30	-	2.00	-	8	-
Deviation	30 minutes	-	0.50	-	2	-
Certified	Declared + deviation - tolerance		Declared x (1+ % deviation - % tolerance)			
	1h10	2h10	2.25	1.98	9	10.8

C.5.4.2 Simulation

The applicable tolerances until the end of 2015 to declared values as part of simulation are defined as follows:

- + 30 min for temperature stabilization times (th),
- - 15% for spare capacities (P_{es}),
- - 15% for performance coefficients in DHW production mode (COP_{DHW} and COP_{global}) for a given tapping cycle.
- - 2 K for reference hot water temperatures (θ'_{WH}),
- - 15% for maximum effective hot water volumes according to (V_{MAX}),

Analysis of the results must allow a revision of theses tolerances.

On the test machine, each performance is simulated. For all simulated performance higher than the tests results, the corresponding certified performance of all models, of all ranges of the dual-mode HP to consider, is the simulated performance reduced to the deviation observed on this performance, corrected by the tolerance. Otherwise, the certified performances are the simulated performance.

C.5.5 Performances thresholds

Furthermore, the following thresholds must be followed:

- The temperature stabilisation time t_h : not more than 6 hours in alternating mode and not more than 8 hours in simultaneous mode,
- The maximum effective hot water volume V_{MAX}: greater than 1.2 storage volumes,
- Reference temperature $\theta'_{WH} \geq 52.5$ °C

C.6 QUALITY CONTROL SPECIFICATIONS

The general provisions defined in part 3 of this standard are completed by the following specific requirements

Inspections during production:

The manufacturer shall monitor and measure the product performances to verify that product requirements are met.
The following checks are conducted:

- by the manufacturer,
- by an identified subcontractor.

Within the scope of the NF Mark, the inspection plan implemented must at least consist of the tests and checks listed in the tables below.

Storage tank						
Components		**Inspections**	**Specifications**	**Frequency**	**Comments**	**Item**
Storage tank	All types	General appearance	In accordance the internal operation mode	In accordance with manufacturer inspection plan		Incoming goods/Production
		Dimensional				
		Leaktightness (checks using air or water)	Control value as per the test protocol specified by the manufacturer			
	Stainless steel type	Anticorrosion treatment of welds	In accordance the internal operation mode			
	Internal protective coating by enamelling type	Monitoring of oven temperature				
		Monitoring of oven time				
		Coating thickness				
		General appearance				
	Other type of protective coating	Coating thickness	In accordance the internal operation mode			
		General appearance				
Hydraulic exchangers	All types	General appearance	In accordance the internal operation mode	In accordance with manufacturer inspection plan		Incoming goods/Production
		Dimensional				
		Leaktightness	Control value as per the test protocol specified by the manufacturer	In accordance with manufacturer inspection plan		

Storage tank (continued)					
Components	**Inspections**	**Specifications**	**Frequency**	**Comments**	**Item**
Manufactured insulation	General appearance	In accordance the internal operation mode	On each batch delivery by sampling		Production Incoming goods
	Dimensional				
	Cohesion *(except P.U. foam)*				
	Density				
Insulation injection during production	Injection time	In accordance the internal operation mode	By periodic sampling defined by manufacturer		Production
	Rise time and cream time				
	Density (weighing of a sample)				
	Temperature				
	General appearance				
	Dimensional				
Control *(if not incorporated in heat pump)*					
Control	Functional (trigger threshold…) and dielectric tests	In accordance the internal operation mode	On each appliance	The functions can be tested using signal generators or on finished products.	Production/Final product

Electrical safety					
Resistance (case of systems equipped with electric heating element(s))	Testing as per NF EN 50106	Earth continuity Dielectric strength Operation Leaktightness	On each appliance		Production/Final product
Electrical components	visual-inspection of components and assembly	As per parts list and assembly diagram in the technical file	On each appliance		Production/Final product

STANDARD SHEET 2A: TECHNICAL DATA SHEET

⚠ For all application files, we have to complete one sheet per range of dual-mode heat pump. The following information is to be provided in addition to the information in Appendix A of this standard.

1- DEFINITION OF THE USE OF THE HP COVERED BY THE APPLICATION

☐ Alternating dual-mode HP (according to chart C.1)

- ☐ type 2
- ☐ type 3A
- ☐ type 4
- ☐ type 5
- ☐ type 6
- ☐ type 7A
- ☐ other type (describe)

☐ Simultaneous dual-mode HP (according to chart C.1):

- ☐ type 1
- ☐ type 3B
- ☐ type 7B
- ☐ other type (describe)

2 – DESCRIPTION OF DUAL-MODE HEAT PUMP AND DWH cylinder

Identification of products

⚠ Be very exact in identifying the products below. The identification will be restated word for word on the admission certificate.

Trade mark	Name of range (commercial range)	Reference of the matching heating HP	Reference of the model of the dual-mode HP (if different from heating model)	Reference of the DHW cylinder

Manufacturing plants: ⚠ The following information is to be provided in addition to the information in Appendix A for each plant which manufactures components linked DHW cylinder and for each assembly sited of HP with DHW cylinder.

Corporate name and address of the fabrication plant and/or the assembly site	Designation of the DHW cylinder	Type [Manufacturing of the tank only and/or manufacturing of the cylinder and/or assembly]	Sub-contractors [Yes/No]

3 – MAIN COMPONENTS

FOR DOMESTIC HOT WATER STORAGE SYSTEM (Fill in if covered)						
	STORAGE SYSTEM no. 1		**STORAGE SYSTEM no. 2**		**STORAGE SYSTEM no. ...**	
	Circuit no. 1	**Circuit no. 2**	**Circuit no. 1**	**Circuit no. 2**	**Circuit no. 1**	**Circuit no. 2**
Tank						
Reference / model *(for incorporated components or separate components from the HP)*						
Manufacturer/Brand						
Type						
Capacity (in litres)						
Maximum effective hot water volume						
Maximum DHW temperature without auxiliary heating (°C)						
Maximum DHW temperature with or without auxiliary heating, permitted by tank (°C)						
Dimensions (in metres) Height x width x depth						
Max service pressure of tank (in MPa) of exchanger (in MPa)						
Tank material						
Inner tank coating						
Type of insulation						
Insulation thickness (mm)						
Foaming agent type						
Cooling constant Wh/(K.l.day)						
Jacket material						

Supplementary electric heater						
Manufacturer						
Heating element type (steatite/clad/...)						
Current type (230V~/400V 3~/400V 3N~) and power in (W)						
Exchanger						
Water buffer tank (yes/no)						
Desuperheater (yes/no)						
Double wall double wall material: area in (m^2):						
Tubular Number of windings Lgth. (m) Inner diam. and Outer diam.						
Plate: Manufacturer: Model: Number of plates:						
Position of exchanger in tank (top/centre/bottom)						
DHW circulator/pump						
Manufacturer:						
Model:						
Number:						
Setting position:						
Flow rate assigned to exchanger operation (m^3/h)						
Control						
Control process						
hydraulic or refrigeration circuit switching component						
Technology						

4 – DATA AND CERTIFIED FEATURES

Characteristics and performances for DHW applications (dual-mode)	HP no. 1	HP no. 2	HP no. 3	HP no.....	HP no.....
- Reference of the outdoor unit of dual-mode HP					
- Reference of the indoor unit of dual-mode HP					
- Reference of single-unit					
- Reference of the DHW cylinder					
Nominal voltage (in V)					
Current type (~ 50 Hz or 3~ 50Hz or 3 N~50 Hz)					
Temperature conditions Set-point: …./….._…..°C					
Tapping cycle as per NF EN 16147					
Reference hot water temperature θ'_{WH} (≥ 52.5 °C)					
Temperature rise time t_h (h)					
Max effective hot water volume as per NF EN 16147 - V_{MAX} (l)					
Spare capacity Pes (in kW)					
COP_{DHW} (alternating) or COP_{global} (simultaneous) The ratio heating power/absorbed power is rounded up, with 3 significant figures: to 2 decimal places(*)					
Temperature conditions Set-point: …./….._…..°C					
Tapping cycle as per NF EN 16147					
Reference hot water temperature θ'_{WH} (≥ 52.5 °C)					
Temperature rise time t_h (h)					
Max effective hot water volume as per NF EN 16147 - V_{MAX} (l)					
Spare capacity Pes (in kW)					
COP_{DHW} (alternating) or COP_{global} (simultaneous) (stated with 3 significant figures)					

Examples:

Heating Power [kW]	79.89	79.90	80.00	80.09	80.10	80.00	80.00	80.00	80.00
Absorbed power [kW]	20.00	20.00	20.00	20.00	20.00	20.03	20.02	19.98	19.97
COP	3.99	4.00	4.00	4.01	3.99	4.00	4.00	4.00	4.01

STANDARD SHEET 2B: DECLARATION OF GROUP OG RANGES FOR SIMULATION OF ALTERNINHG MODE HP

Group of range	Name of NF PAC ranges (heating)	Source of heating	Range of tank	Exchanger technology	DHW regulation	Power regulation	Max downstream temperature
A							
B							
C							

Organisme certificateur

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CERTIFICATION REFERENCE
HEAT PUMP – NF MARK

PART 9
APPENDIX D: SPECIFIC REQUIREMENTS FOR GAS ABSORPTION HPs

CONTENTS

Rev 8 – August 2014

D.1 APPLICABILITY:

This part of the NF HP reference defines the specific provisions for gas absorption heat pumps for heating premises, including machines having a cooling function (reversible).

The cooling function can only be certified with the space heating function.

The certified characteristics are:

- The gas utilisation efficiency (GUE),
- The heating capacity,
- The absorbed electrical power,
- The acoustic power level.

The following characteristics can be optionally certified:

- The particular characteristics of variable power regulation HPs:
  - The minimum continuous operation Load Ratio (LRcontmin),
  - The GUE at LRcontmin.
  - The performance correction coefficient at LRcontmin (CcpLRcontmin),
- The electrical power of the auxiliaries at zero load (Paux0)

Additionally, for the cooling function, the following characteristics can also be certified:

- The gas utilisation efficiency (GUE),
- The cooling power.

The products covered are defined according to the following types:

- “outdoor air/water” type,
- “glycol-water/water mix or glycol-water”,
- “(ground)water/water” type,

D.2. REFERENCE DOCUMENTS:

The standards mentioned in §2.2.2 are completed by the following:

- NF EN 12309 (December 1999) Gas-fired absorption and adsorption air-conditioning and/or heat pump appliances with a net heat input not exceeding 70 kW
  - Part 1(December 1999): Safety.
  - Part 2 (August 2000): Rational use of energy.
- Pr EN 12309 (December 2011) Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW
  - Part 1: "Terms and definitions"
  - Part 3: "Test conditions"
  - Part 4 - "Test methods"
  - Part 5: "Requirements"
- NF EN 14825 (November 2013): Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling – Testing and rating at part load conditions.

D.3. DEFINITION OF SYSTEMS AND RANGES

A gas absorption heat pump system consists of the following components:

- a boiler (generator)
- a gas burner and the components required to supply the combustion air and discharge the combustion products
- a refrigeration circuit
- a condenser
- an expansion device
- an evaporator
- an absorber
- a solution pump
- a control system
- a type of exchanger(s), if applicable (enriched solution / depleted solution)

An absorption heat pump range comprises products with the same components, namely:

- same refrigeration process (e.g. GAX type absorption)
- same refrigerant
- same boiler (generator) type
- same expansion valve type
- same evaporator type
- same absorber type
- same solution pump type
- same condenser type
- same defrost principle (hot gas injection valve)
- same power regulation principle (e.g. burner power modulation)
- same exchanger type (enriched solution / depleted solution)

Special case:

- For a range of appliances offering options incorporated into the heat pump, these constitute different ranges if such options have an impact on the certified features of the heat pump. In this case, the applicant shall complete separate applications for the right to use the NF mark.
- A heat pump range with reversible (heating and cooling) and standard versions (heating only) and for which the commercial references or brands are different (from one version to the next) is considered to comprise two ranges. Tests shall be performed according to the following cases:
    a- The certified features stated in the applications are the same for both versions; only the products in the reversible version are submitted for testing.
    b- The certified features stated in the applications are different for both versions; in this case, the products in each version are submitted for testing.

NB:
Should both versions have the same commercial references or brands and the same stated certified features, only one range is taken into consideration. The tests are carried out on the reversible version products of the range.

D.4. TECHNICAL SPECIFICATIONS AND CHARACTERISATION METHODS

Principles:

- The thermal and acoustic performance declarations are verified by specific tests,
- GUE thresholds are set for certain operating points,
- Acoustic power thresholds are set for certain HP heating capacity levels,
- Cold starting is envisaged for certain HP types.

Operating ranges:

The operating ranges for each HP are declared by the applicant / holder and can be in whole or in part (for example an operating point) performance matrices given below and taken from RT 2012 as appropriate. The matrix lines declared by the applicant / holder (corresponding to the HP operating points) do not necessarily include the line featuring the RT 2012 pivot point.

However, as a minimum for the heating function, a certified point must correspond to an operating point with a GUE threshold defined in the matrices below.

Intermediate operating points (corresponding to intermediate columns of the matrices) relative to those provided by the performance matrices below can be declared for certification.

The lower upstream temperature limit is set at -15°C for outdoor air.
Operating points at temperatures greater than those provided by the performance matrices below can be declared.

Note 1: as a reminder, if the pivot value is not certified, the certified characteristics cannot be validated under RT 2012.
Note 2: the optional individual characteristics of variable regulation HPs are preferably determined at the pivot point.
Note 3: when requested, the share of electrical power for the auxiliaries is preferably measured at the pivot point.

Test program:

The test programme is defined for each case according to the HP type and declared operating range so as:

- To be able to verify the characteristics at the RT 2012 matrix pivot point if appropriate,
- To permit the selection by CERTITA of at least 1 operating point,
- To take account of any specific justified requests from the applicant.

The selection of the number of products to be tested in a range is defined in § 3.1.3.2.

The number of tests to be performed to certify the desired points of the performance matrix is a function of the number of downstream temperatures declared:

- For air/water HPs: 3 tests for a declared line and 1 test per additional line,
- For other HP types: 2 tests for a declared line and 1 test per additional line.

Note 1: when an applicant declares a number of operating points less than or equal to the number of tests to be performed, the number of tests to be performed is equal to the number of points declared (the applicant can for example request 1 operating point for certification, 1 test will be performed at the declared operating point).

If appropriate, the individual characteristics of variable power regulation HPs are determined at 1 operating point, at the pivot point conditions if declared.

If appropriate, the share of electrical power for auxiliaries is determined at 1 operating point, at the pivot point conditions if declared.

Conditions for validation of declared values for heating capacities:

If the declared values comply with the measured values taking the applicable tolerances into account, they are validated.

The applicable tolerances on the declared values are defined as follows:

- max (5%; 20.5 * $\Delta T^{-0.89}$), for heating capacities measured for water and the corresponding GUE,
- 5% for heating capacities for air measured in steady state by the room calorimeter method and the corresponding GUE,
- 10% for heating capacities for air measured in transient regime (defrosting cycles)
- by the room calorimeter method and the corresponding GUE,
- 10% for heating capacities for air measured by the enthalpy method for air and the corresponding GUE,

If the declared values do not comply with the measured values, they are reset to the measured values, corrected by the applicable tolerance.

For values corresponding to unmeasured points, the declared values are corrected by a value equal to the mean differences relative to the compliance thresholds; this mean is calculated solely from the non-compliant measured values (see example below).

Example of validation of declared values

Air/water HP Comparison between declared and measured powers (kW)										
Downstream temperature (°C)		**Upstream temperature (air side) (°C)**								
T flow (°C)	T return (°C)	-7			2			7		
		Declared	Measured	Difference (%)	Declared	Measured	Difference	Declared	Measured	Difference
35	**30**	**4,20**	**4,00**	**4,8**	**3,40**			**7,20**	**6,60**	**8,3**
45	**40**	**4,00**	**3,70**	**7,5**	**2,80**	**2,50**	**10,7**	**7,40**		

Tolerance on Powers = 5%
Processing of values:

- Measured values compliant: 4 ,0 : validated value = declared value = 4.2
- Measured values non-compliant: validated value = measured value x 1.05
- Unmeasured values: validated value = Declared value corrected by the mean of the relative differences with respect to the compliance thresholds, mean calculated from non-compliant values only.
- Mean relative differences with respect to compliance thresholds: (5,7+2,5+3,3)/3= **3,8 %**

New corrected matrix:

Downstream temperature (°C)		**Upstream temperature (air side) (°C)**								
T flow (°C)	T return (°C)	-7			2			7		
		Declared	Measured	Validated	Declared	Measured	Difference	Declared	Measured	Validated
35	**30**	**4,20**	**4,00**	**4,80**	**3,40**		**3,30**	**7,20**	**6,60**	**6,90**
45	**40**	**4,00**	**3,70**	**3,90**	**2,80**	**2,50**	**2,60**	**7,40**		**7,10**

Special test conditions:

For heat pumps covered by this appendix, the tests are conducted according to the test protocol define in Part 10 Appendix EE.

For heat pumps with continuous variable capacity control (inverter compressor or other type of power variation), the manufacturer must provide the laboratory with the corresponding setting procedure for obtaining the declared operating points.
During the different heating capacity measurement tests, the supply voltage frequencies and/or speeds are noted for compressors and fans and mentioned in the test report.

For HPs with air connections, the connection specifications defined for the sound tests (see Appendix AA) also apply to thermal tests, meaning use of the same connection ducts.

For a heat pump range that can be installed (as it is or with optional equipment) indoors or outdoors, in which the pressure in the discharge duct (towards the outside) is less than 25 Pa; the heating capacity measurement tests are conducted in the outdoor free air blowing configuration with a pressure equal to 0.

D.4.1 Energy performance in heating mode

The energy performance in heating mode, meaning the heating capacity, the absorbed electrical power and the GUE, must be determined under the conditions below. GUE thresholds are defined for certain operating points and must be respected.
The corresponding GUE matrices appear in the § below for each HP type with the following conventions:

- When a GUE value is explicitly mentioned, it defines the applicable threshold for the corresponding operating point,
- The matrix items highlighted in yellow correspond to any pivot points defined in RT 2012.

D.4.1.1 Outdoor air – water HP

The heat pump must be started up to validated the operating range, taking an outdoor temperature of -15°C and a mean water temperature provided by the manufacturer. The water flow rate used for the test is that corresponding to the first application requested and should preferably be at the pivot point.

For single-unit heat pumps installed indoors or for the indoor unit of split HPs, the indoor environment is at ambient temperature.

The HP must be able to start and operate for 20 minutes.

Matrix as per RT 2012	T upstream (outdoor air) (°C)				
	-15	-7	2	7	20
T downstream (water) (°C)					
30		1,20		1,40	
35		1,10		1,35	
45		1,00		1,30	
50		0,9		1,20	
60		0,7		0,9	

Table of test conditions as per Pr EN 12309-3		T upstream (outdoor air) (°C)					
		-15	-7	2	7	12	20
T downstream (water) (°C)							
T flow	T return						
35	*						
45	*						
55	*						
65	*						

*: as per Pr EN 12309-3 standard

D.4.1.2 - Ground water – water HP

Matrix as per RT 2012	T upstream (ground water) (°C)			
T >	2,5	7,5	12,5	17,5
T downstream (water) (°C)				
30		1,52		
35		1,50		
45		1,40		
50		1,35		
60		1,25		

Table of test conditions as per Pr EN 12309-3		T upstream (ground water) (°C)	
T return		10	15
T flow		*	*
T downstream (water) (°C)			
T flow	T return		
35	*		
45	*		
55	*		
65	*		

*: as per Pr EN 12309-3 standard

D.4.1.3 - Glycol water – water or glycol water – glycol water HP

Matrix as per RT 2012	T upstream (glycol water) (°C)				
T >	-2,5	2,5	7,5	12,5	17,5
T downstream (water or glycol water) (°C)					
30	1,50				
35	1,50				
45	1,40				
50	1,35				
60	1,25				

Table of test conditions as per Pr EN 12309-3		T upstream (glycol water) (°C)				
	T return	-5	0	5	10	15
	T flow	*	*	*	*	*
T downstream (water or glycol water) (°C)						
T flow	T return					
35	*					
45	*					
55	*					
65	*					

*: as per Pr EN 12309-3 standard

D.4.2 Energy performance in cooling mode

The energy performance in cooling mode, meaning the cooling capacity, and the GUE, must be determined under the conditions below. There is no defined GUE threshold.

The corresponding GUE matrices appear in the § below for each HP type. The matrix items highlighted in yellow correspond to any pivot points defined in RT 2012.

D.4.2.1 Outdoor air – water HP

Matrix as per RT 2012	T upstream (outdoor air) (°C)				
	5	15	25	35	45
T downstream (water) (°C)					
4					
9,5					
15					
20,5					
26					

Table of test conditions as per Pr EN 12309-3		T upstream (outdoor air) (°C)		
		27	35	46
T downstream (water) (°C)				
T flow	T return			
7	*			
18	*			

*: as per Pr EN 12309-3 standard

D.4.2.2 - Ground water – water HP

Matrix as per RT 2012	T upstream (ground water) (°C)				
T >	2,5	12,5	22,5	32,5	42,5
T downstream (water) (°C)					
4					
9,5					
15					
20,5					
26					

Table of test conditions as per Pr EN 12309-3		T upstream (ground water) (°C)
	T return	30
	T flow	35
T downstream (water) (°C)		
T flow	T return	
7	12	
18	23	

D.4.2.3 - Glycol water – water or glycol water – glycol water HP

Matrix as per RT 2012	T upstream (glycol water) (°C)				
T >	2,5	12,5	22,5	32,5	42,5
T downstream (water or glycol water) (°C)					
4					
9,5					
15					
20,5					
26					

Table of test conditions as per Pr EN 12309-3		T upstream (glycol water) (°C)
	T return	30
	T flow	35
T downstream (water or glycol water) (°C)		
T flow	T return	
-5	0	
7	12	
18	23	

D.4.3 Acoustic power level

Sound power levels shall be determined under the conditions set out in Appendix AA (Part 10) of this certification standard. Outside the building, they must comply with the following thresholds:

Heating capacity (in kW)	Sound power (in dB(A))
0 ?power ≤ 10	≤ 70
10 ?power ≤ 20	≤ 73
20 ?power ≤ 50	≤ 78
50 ?power ≤ 100	No threshold defined

If the measured sound power level of a product exceeds the declared level for the product by more than 2 dB(A), all the range values must be changed on the basis of the deviation observed on the tested product, between the declared sound power value and the test report result.

D.4.4. Special characteristics of variable power regulation HPs

The manufacturer shall send the means to obtain the minimum continuous operation load ratio from his product under evaluation ($LR_{contmin}$).
A heating capacity test at this load ratio is performed to verify the continuous operation of the HP (no cycling) and record the following performance values:

- The heating capacity so obtained is compared to the heating capacity obtained at the same operating point (pivot point of the matrix if declared) and LRcontmin is calculated.
  If the difference between the calculated value and the value of LRcontmin declared by the manufacturer is less than 10% of the declared value, the value of LRcontmin is then validated.
- if the value of LRcontmin is validated, the GUE at $LR_{contmin}$ is measured and validated, the $Ccp_{LRcontmin}$ is then calculated and validated.

Note: $LR_{contmin}$ is defined relative to the declared heating capacity at full load at the same operating points.
$Ccp_{LRcontmin}$ corresponds to the ratio of GUE at $LR_{contmin}$ and GUE at full load at the same operating temperatures.

D.4.5. Share of electrical power for the auxiliaries

The share of the electrical power for the auxiliaries in the total electrical power (Ratio) is the ratio between these two powers.
The electrical power of the auxiliaries is measured as per § 6.4.2.2 of Pr EN 12309-4.

D.5. QUALITY CONTROL SPECIFICATIONS

The quality control provisions stated in § 2.3 of the reference apply for these products.
In addition, for these types of heat pumps and for the hydraulic circuit leak tests (§2.3.3.2.2), the manufacturer must conduct a leak test at at least 0.8 times the maximum rated pressure (Ps) to ensure the absence of leaks.

STANDARD SHEET 2: TECHNICAL DATA SHEET

⚠ For all certification application, one sheet must be completed per heat pump range

1- DEFINITION OF THE USE OF THE ABSORPTION HP COVERED BY THE APPLICATION

☐"Space heating" HP
☐with "cooling" option

2 – DESCRIPTION OF THE ABSORPTION HEAT PUMP

Identification of products:

⚠ **Be very exact in identifying the products below. These identifications will be restated word for word on the admission certificate.**

- Trademark: ....

- Commercial brand *(group name (range) of heat pumps*):
.....

- Model names or references:
.....
.....

Assembly unit(s):

⚠ **To be filled in for each manufacturing site that produces machines covered by the application (packages, outdoor unit, and indoor unit)**

Name of the machine or units	Corporate name and address of manufacturing site
.... ……	....
.... ……	....
NB: Reproduce as many times as necessary	

Type of heat pump subject to the application: (tick the relevant box(es))

☐Outdoor air/Water HP – single-unit
- ☐ ductless outdoor installation
- ☐ ducted indoor installation

☐Glycol water/Water HP – single unit
- ☐ outdoor installation
- ☐ indoor installation

☐Glycol water/Glycol water HP – single unit
- ☐ outdoor installation
- ☐ indoor installation

☐Ground water/Water HP – single-unit
- ☐ outdoor installation
- ☐ indoor installation
- ☐ With barrier exchanger
- ☐ Without barrier exchanger

3 – INFORMATION ON THE HEAT PUMP AND/OR ITS VARIOUS SEPARATE COMPONENTS

✓ **HP installation site (*tick the relevant box*) :**

☐ Outdoors ☐ Indoors

✓ **Defrosting** (principle): .....
.....

✓ **Regulation** (principle):.....
.....

✓ **Setting condition** of the HP for the requested applications (for: Defrost, Other), if applicable
.....
.....
.....

Do settings require work by the applicant? ☐ YES ☐ NO

✓ **Continuous power regulation HPs:** if applicable, description of means for obtaining the minimum continuous operation load ratio ($LR_{contmin}$)

✓ **Acoustic**: if applicable, specific installation conditions for the HP

✓ **Heat pump equipment** (*tick the relevant box(es)*)

☐Boiler (generator)

☐Burner with On/Off or modulating type. Modulation range: ……

☐Variable speed fan

☐Expansion valve with type (fixed, thermostatic, electronic, …)

☐ Absorber

☐Internal heat recovery unit

☐Solution pump with type

☐Domestic hot water production included in the HP

☐Other equipment or accessories:

.....

.....

If the equipment mentioned below is not installed on all the models, it must be subject to separate right of use applications. However, we invite you to contact CERTITA to confirm this.

☐Reversible cycle cooling operation *(reversible heat pump)*

☐ Circulation pump for collectors

☐Multiple speed circulation pump. Number: ……

☐Variable speed pump

☐Circulation pump for the heating circuit

☐Multiple speed circulation pump. Number: ……

☐Variable speed pump

☐Accumulator (buffer tank)

✓ **requested operating points**:

Depending on the HP categories covered by the application (heating and reversible if appropriate, swimming pools), the requested operating point shall be detailed in the data and characteristics tables given below.

✓ **Starting point at -15°C** :

For Outdoor Air – Water type heat pumps, an HP starting point must be carried out to validate the operating range. To enable the laboratory to conduct the test, we ask that you specify below the maximum water temperature, for an outdoor temperature of -15°C. This value will be restated on the NF mark admission decision for the range.

Maximum water temperature = ……. °C

4 – MAIN COMPONENTS OF THE HEAT PUMP

	HP no. 1	HP no. 2	HP no. ….
Reference / model			
Liquid refrigerant (binary mixture)			
Type			
Load (kg)			
Absorbent (binary mixture)			
Type			
Load (kg)			
Corrosion inhibitor			
Type			
Load (kg)			
Generator (thermochemical compression)			
Burner (characteristics)			
Solution pump			
Type			
Expansion device			
Type			
Manufacturer			
Model			
Liquid receiver			
Volume (in l)			

5 – DATA AND CERTIFIED FEATURES FOR SINGLE UNITS

⚠ In the case of an application for "reversible" HPs, complete the following table for each of the two functions.

Characteristics for heating applications	**HP no. 1**	**HP no. 2**	**HP no. 3**	**HP no.….**	**HP no.….**
Reference/Model of the heat pump:					
- Reference of unit					
Nature of gas heat input under nominal conditions					
Feed pressure					
Nominal voltage (in V)					
Nature of single- or three-phase current (50 Hz)					
If applicable Regulation changeover threshold LRcontmin					
Performance correction coefficient CcpLrcontmin					
The share of electrical power for the auxiliaries Ratio					
Standby power (in W)					
Temperature conditions …._…./…._….℃					
Heating capacity (in kW)					
Absorbed power (in kW)					
GUE_h (stated with 3 significant figures)					
Temperature conditions …._…./…._….℃					
Heating capacity (in kW)					
Absorbed power (in kW)					
GUE_h (stated with 3 significant figures)					
Temperature conditions …._…./…._….℃					
Heating capacity (in kW)					
Absorbed power (in kW)					
GUE_h (stated with 3 significant figures)					
Sound power (in dB(A), stated in 1/10th) **under the temperature conditions → …._…./…._….℃ for:** (see test diagrams)					
Noise radiated by the casing					
Global noise of openings					

Characteristics for cooling applications	**HP no. 1**	**HP no. 2**	**HP no. 3**	**HP no.….**	**HP no.….**
Reference/Model of the heat pump <u>or combination</u>:					
- Reference of outdoor unit					
- Reference of indoor unit					
Nominal voltage (in V)					
Current type (~ 50 Hz or 3~ 50Hz or 3 N~50 Hz)					
Temperature conditions ….._…../….._…..°C					
Cooling capacity (in kW)					
Absorbed power (in kW)					
GUE_c (stated with 3 significant figures)					
Temperature conditions ….._…../….._…..°C					
Cooling capacity (in kW)					
Absorbed power (in kW)					
GUE_c (stated with 3 significant figures)					
Temperature conditions ….._…../….._…..°C					
Cooling capacity (in kW)					
Absorbed power (in kW)					
GUE_c (stated with 3 significant figures)					
Temperature conditions ….._…../….._…..°C					
Cooling capacity (in kW)					
Absorbed power (in kW)					
GUE_c (stated with 3 significant figures)					

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CERTIFICATION REFERENCE
HEAT PUMP – NF MARK

PART 9
APPENDIX E - SPECIFIC REQUIREMENTS FOR GAS ENGINE-DRIVEN HPs

CONTENTS

Rev 8 – August 2014

E.1 APPLICABILITY:

This part of the NF HP reference defines the specific provisions for engine-driven gas heat pumps for heating premises, including machines having a cooling function (reversible).
The cooling function can only be certified with the space heating function.

The products covered are defined according to the following types:

- "outdoor air/water" type,
- "outdoor air/recycled air" type

The certified characteristics are:

- The gas utilisation efficiency (GUE),
- The heating capacity,
- The absorbed electrical power,
- The acoustic power level.

The following characteristics can be optionally certified:

- The particular characteristics of variable power regulation HPs:
  - The minimum continuous operation Load Ratio (LRcontmin),
  - The GUE at LRcontmin.
  - The performance correction coefficient at LRcontmin (CcpLRcontmin),
- The electrical power of the auxiliaries at zero load (Paux0)
- Additionally, for the cooling function, the following characteristics can also be certified:
  - The gas utilisation efficiency (GUE),
  - The cooling power.

E.2. REFERENCE DOCUMENTS:

The standards mentioned in §2.2.2 are completed by the following:

NF EN 14511-1 (October 2013): Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling

- Part 1 - "Terms and definitions"
- Part 2: - "Test conditions"
- Part 3: - "Test methods
- Part 4: - "Requirements"

NF EN 14825 (November 2013): Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling – Testing and rating at part load conditions.

E.3. DEFINITION OF SYSTEMS AND RANGES

An engine-driven gas heat pump system consists of the following components:

- a gas heat engine
- a heat sink
- one or more compressor(s)
- a refrigeration circuit
- a condenser
- an expansion device
- an evaporator
- a control system

An engine-driven gas heat pump range comprises products with the same components, namely:

- same refrigeration process (for example, number of compressors or stages)
- same refrigerant
- same heat engine type
- same compressor type
- same expansion valve type
- same heat recovery unit type
- same evaporator type
- same condenser type
- same defrost principle (hot gas injection valve)
- same power regulation principle (refrigerant performance management)
- same heat recovery regulation principle

Special case:

- For a range of appliances offering options incorporated into the heat pump, these constitute different ranges if such options have an impact on the certified features of the heat pump. In this case, the applicant shall complete separate applications for the right to use the NF mark.
- A heat pump range with reversible (heating and cooling) and standard versions (heating only) and for which the commercial references or brands are different (from one version to the next) is considered to comprise two ranges. Tests shall be performed according to the following cases:
    a- The certified features stated in the applications are the same for both versions; only the products in the reversible version are submitted for testing.
    b- The certified features stated in the applications are different for both versions; in this case, the products in each version are submitted for testing.

NB:
Should both versions have the same commercial references or brands and the same stated certified features, only one range is taken into consideration. The tests are carried out on the reversible version products of the range.

E.4. TECHNICAL SPECIFICATIONS AND CHARACTERISATION METHODS

Principles:

- The thermal and acoustic performance declarations are verified by specific tests,
- GUE thresholds are set for certain operating points,
- Acoustic power thresholds are set for certain HP heating capacity levels,
- Cold starting is envisaged for certain HP types.

Operating ranges:
The operating ranges for each HP are declared by the applicant / holder and can be in whole or in part (for example an operating point) performance matrices given below.
However, as a minimum for the heating function, a certified point must correspond to an operating point with a GUE threshold defined in the matrices below.
Intermediate operating points (corresponding to intermediate columns of the matrices) relative to those provided by the performance matrices below can be declared for certification.
The lower upstream temperature limit is set at -15°C for outdoor air.
Operating points at temperatures greater than those provided by the performance matrices below can be declared.

Test programme:

The test programme is defined for each case according to the HP type and declared operating range so as:

- To allow the selection by CERTITA of at least 1 operating point,
- To take account of any specific justified requests from the applicant.

The selection of the number of products to be tested in a range is defined in § 3.1.3.2.

The number of tests to be performed to certify the desired points of the performance matrix is a function of the number of downstream temperatures declared:

- For air/water HPs: 3 tests for a declared line and 1 test per additional line,
- For other HP types: 2 tests for a declared line and 1 test per additional line.

Note 1: when an applicant declares a number of operating points less than or equal to the number of tests to be performed, the number of tests to be performed is equal to the number of points declared (the applicant can for example request 1 operating point for certification, 1 test will be performed at the declared operating point).

If applicable, the particular characteristics of variable power regulation HPs are determined at 1 operating point.
If applicable, the share of electrical power of the auxiliaries is determined at 1 operating point.

Conditions for validation of declared values for heating capacities:
If the declared values comply with the measured values taking the applicable tolerances into account, they are validated.
The applicable tolerances on the declared values are defined as follows:

- 5%, for the heating capacities measured for water and the corresponding GUE,
- 5% for heating capacities for air measured in steady state by the room calorimeter method and the corresponding GUE,
- 10% for heating capacities for air measured in transient regime (defrosting cycles)
- by the room calorimeter method and the corresponding GUE,
- 10% for heating capacities for air measured by the enthalpy method for air and the corresponding GUE,

If the declared values do not comply with the measured values, they are reset to the measured values, corrected by the applicable tolerance.

For values corresponding to unmeasured points, the declared values are corrected by a value equal to the mean differences relative to the compliance thresholds; this mean is calculated solely from the non-compliant measured values (see example below).

Example of validation of declared values

Air/water HP Comparison between declared and measured powers (kW)										
Downstream temperature (°C)		**Upstream temperature (air side) (°C)**								
T flow (°C)	T return (°C)	-7			2			7		
		Declared	Measured	Difference (%)	Declared	Measured	Difference	Declared	Measured	Difference
35	**30**	**4,20**	**4,00**	**4,8**	**3,40**			**7,20**	**6,60**	**8,3**
45	**40**	**4,00**	**3,70**	**7,5**	**2,80**	**2,50**	**10,7**	**7,40**		

Tolerance on Powers = 5%
Processing of values:

- Measured values compliant: 4 ,0 : validated value = declared value = 4.2
- Measured values non-compliant: validated value = measured value x 1.05
- Unmeasured values: validated value = Declared value corrected by the mean of the relative differences with respect to the compliance thresholds, mean calculated from non-compliant values only.
- Mean relative differences with respect to compliance thresholds: (5,7+2,5+3,3)/3= **3,8 %**

New corrected matrix:

Downstream temperature (°C)		**Upstream temperature (air side) (°C)**								
T flow (°C)	T return (°C)	-7			2			7		
		Declared	Measured	Validated	Declared	Measured	Difference	Declared	Measured	Validated
35	**30**	**4,20**	**4,00**	**4,80**	**3,40**		**3,30**	**7,20**	**6,60**	**6,90**
45	**40**	**4,00**	**3,70**	**3,90**	**2,80**	**2,50**	**2,60**	**7,40**		**7,10**

Special test conditions:

For heat pumps covered by this appendix, the tests are conducted according to the test protocol define in Part 10 Appendix EE.

For heat pumps with continuous variable capacity control (inverter compressor or other type of power variation), the manufacturer must provide the laboratory with the corresponding setting procedure for obtaining the declared operating points.
During the different heating capa city measurement tests, the supply voltage frequencies and/or speeds are noted for compressors and fans and mentioned in the test report.

For HPs with air connections, the connection specifications defined for the sound tests (see Appendix AA) also apply to thermal tests, meaning use of the same connection ducts.

For a heat pump range that can be installed (as it is or with optional equipment) indoors or outdoors, in which the pressure in the discharge duct (towards the outside) is less than 25 Pa; the heating capacity measurement tests are conducted in the outdoor free air blowing configuration with a pressure equal to 0.

E.4.1 Energy performance in heating mode

The energy performance in heating mode, meaning the heating capacity, the absorbed electrical power and the GUE, must be determined under the conditions below. GUE thresholds are defined for certain operating points and must be respected.
The corresponding GUE matrices appear in the § below for each HP type. It should be noted that, when a GUE value is explicitly mentioned, it defines the applicable threshold for the corresponding operating point,

E.4.1.1 Outdoor air – water HP

The heat pump must be started up to validated the operating range, taking an outdoor temperature of -15°C and a mean water temperature provided by the manufacturer. The water flow rate used for the test is that corresponding to the first application requested.

For single-unit heat pumps installed indoors or for the indoor unit of split HPs, the indoor environment is at ambient temperature.

The HP must be able to start and operate for 20 minutes.

		T upstream (outdoor air) (°C)				
		-15	-7	2	7	20
T downstream (water) (°C)						
T flow	T return (*)					
25	22		0,50		1,29	
35	30		0,56		1,26	
45	40		0,53		1,10	
55	47		0,50		0,90	
65	55		0,40		0,60	

(*): For an upstream temperature of 7 °C. For any other source upstream temperature, the test is performed with the nominal flow rate obtained during the 7 °C test.

E.4.1.2 Outdoor air – recycled air HP

The heat pump must be started up to validate the operating range by taking an outdoor temperature of -15°C and an indoor temperature of 15°C.
The HP must be able to start and operate for 20 minutes.

	T upstream (outdoor air) (°C)				
	-15	-7	2	7	20
T downstream (recycled air) (°C)					
5					
10					
15					
20		0,70		1,30	
25					

E.4.2 Energy performance in cooling mode

The energy performance in cooling mode, meaning the cooling capacity, and the GUE, must be determined under the conditions below. There is no defined GUE threshold.

The corresponding GUE matrices appear in the § below for each HP type.

E.4.2.1 Outdoor air – water HP

		T upstream (outdoor air) (°C)				
		5	15	25	35	45
T downstream (water) (°C)						
T flow	T return (*)					
1,5	6,5					
7	12					
12,5	17,5					
18	23					
23,5	28,5					

(*): For an upstream temperature of 35 °C. For any other source upstream temperature, the test is performed with the nominal flow rate obtained during the 35 °C test.

E.4.2.2 Outdoor air – recycled air HP

	T upstream (outdoor air) (°C)				
	5	15	25	35	45
T downstream (recycled air) (°C)					
22					
27					
32					
37					

E.4.3 Acoustic power level

Sound power levels shall be determined under the conditions set out in Appendix AA (Part 10) of this certification standard. Outside the building, they must comply with the following thresholds:

Heating capacity (in kW)	Sound power (in dB(A))
0 <power ≤ 10	≤ 70
10 <power ≤ 20	≤ 73
20 <power ≤ 50	≤ 78
50 <power ≤ 100	No threshold defined

If the measured sound power level of a product exceeds the declared level for the product by more than 2 dB(A), all the range values must be changed on the basis of the deviation observed on the tested product, between the declared sound power value and the test report result.

E.4.4. Special characteristics of variable power regulation HPs

The manufacturer shall send the means to obtain the minimum continuous operation load ratio from his product under evaluation ($LR_{contmin}$).
A heating capacity test at this load ratio is performed to verify the continuous operation of the HP (no cycling) and record the following performance values:

- The heating capacity obtained in this way is compared to the heating capacity obtained at the same operating point and LRcontmin is calculated.
  If the difference between the calculated value and the value of LRcontmin declared by the manufacturer is less than 10% of the declared value, the value of LRcontmin is then validated.
- if the value of LRcontmin is validated, the COP at LRcontmin is measured and validated, the CcpLRcontmin is then calculated and validated.

Note: LRcontmin is defined relative to the declared heating capacity at full load at the same operating points.
$Ccp_{LRcontmin}$ corresponds to the ratio of GUE at $LR_{contmin}$ and GUE at full load at the same operating temperatures.

E.4.5. Share of electrical power for the auxiliaries

The share of the electrical power for the auxiliaries in the total electrical power (Ratio) is the ratio between these two powers.
The electrical power for the auxiliaries is measured with the appliance in standby mode according to the provisions of standard Pr NF EN 14825.

E.5. QUALITY CONTROL SPECIFICATIONS

The quality control provisions stated in § 2.3 of the reference apply for these products.
In addition, for these types of heat pumps and for the hydraulic circuit leak tests (§2.3.3.2.2), the manufacturer must conduct a leak test at at least 0.8 times the maximum rated pressure (Ps) to ensure the absence of leaks.

STANDARD SHEET 2: TECHNICAL DATA SHEET

(TO BE COMPLETED FOR ALL CERTIFICATION APPLICATIONS)

NB: ONE sheet must be completed per heat pump range

1- DEFINITION OF THE USE OF THE ENGINE-DRIVEN HP COVERED BY THE APPLICATION

☐"Space heating" HP

☐with "cooling" option

2 – DESCRIPTION OF THE ENGINE-DRIVEN HEAT PUMP

Identification of products:

⚠ Be very exact in identifying the products below. These identifications will be restated word for word on the admission certificate.

- Trademark: ....

- Commercial brand *(group name (range) of heat pumps*):

.....

- Model names or references:

.....

.....

- References or names for single-splits or multi-splits:

(If necessary, fill in per type (wall, bracket, etc) and each component (indoor units))

.....

.....

.....

Assembly unit(s):

⚠ To be filled in for each manufacturing site that produces machines covered by the application (packages, outdoor unit, indoor unit)

Name of the machine or units	Corporate name and address of manufacturing site
....	....
....	....

NB: Reproduce as many times as necessary

Type of heat pump subject to the application: (tick the relevant box(es))

☐Outdoor air/Recycled air HP – single-unit
- ☐ ductless indoor installation
- ☐ ducted indoor installation
- ☐ ducted outdoor installation

☐Outdoor air/Recycled air HP – single-split
- ☐ ductless
- ☐ ducted

☐Outdoor air/Recycled air HP – multi-split
- ☐ ductless
- ☐ ducted

☐Outdoor air/Water HP – single-unit
- ☐ ductless outdoor installation
- ☐ ducted indoor installation

3 – INFORMATION ON THE HEAT PUMP AND/OR ITS VARIOUS SEPARATE COMPONENTS

✓ **HP installation site** (tick the relevant box) :

☐ Outdoors ☐ Indoors

Note, for splits and multi-splits:
The components are considered to be separate by definition. One part outdoors and the other part indoors. Please specify the location if this is not the case.

.....
.....

✓ **Defrosting** (principle): .....
.....

✓ **Regulation** (principle):.....
.....

✓ **Setting condition** of the HP for the requested applications (for: Expansion, Defrost, Other), if applicable

.....
.....
.....

Do settings require work by the applicant? ☐ YES ☐ NO

✓ **Continuous power regulation HPs:** if applicable, description of means for obtaining the minimum continuous operation load ratio ($LR_{contmin}$)

✓ **Acoustic**: if applicable, specific installation conditions for the HP

✓ **Pressure on the air** for appliances with ducting: …… *(give value)*

✓ **Heat pump equipment** (tick the relevant box(es))

☐Variable speed compressor (Engine speed variation, compressor staging, etc.)

☐Multiple speed fan. Number: ……

☐Variable speed fan

☐Expansion valve with type (thermostatic, electronic, …)

☐Exchanger cooling operation (free cooling)

☐Heater

☐Domestic hot water production included in the HP

☐Other equipment or accessories:

.....

.....

If the equipment mentioned below is not installed on all the models, it must be subject to separate right of use applications. However, we invite you to contact CERTITA to confirm this.

☐Reversible cycle cooling operation *(reversible heat pump)*

☐Passive cooling mode operation

☐ Circulation pump for collectors

☐Multiple speed circulation pump. Number: ……

☐Variable speed pump

☐Circulation pump for the heating circuit

☐Multiple speed circulation pump. Number: ……

☐Variable speed pump

☐Accumulator (buffer tank)

✓ **requested operating points**:

Depending on the HP categories covered by the application (heating and reversible if appropriate, swimming pools), the requested operating point shall be detailed in the data and characteristics tables given below.

✓ **Starting point at -15°C** :

For Outdoor Air – Water type heat pumps, an HP starting point must be carried out to validate the operating range. To enable the laboratory to conduct the test, we ask that you specify below the maximum water temperature, for an outdoor temperature of -15°C. This value will be restated on the NF mark admission decision for the range.

Maximum water temperature = ……. °C

4 – MAIN COMPONENTS OF THE HEAT PUMP

	HP no. 1	**HP no. 2**	**HP no. ….**
Reference / model			
Liquid refrigerant			
Type			
Load (kg)			
Compressor			
Type (Piston, Scroll, etc.)			
Trade name			
Model			
Number			
Heat engine			
Number of cylinders/total cubic capacity			
Trade name			
Model			
Expansion device			
Type			
Manufacturer			
Model			
Hydraulic module (air/water version)			
Type			
Model			
Module regulation			
Liquid receiver			
Volume (in l)			

FOR INDOOR EXCHANGER - AIR *(Fill in if covered)*			
	HP no. 1	**HP no. 2**	**HP no. ….**
Reference / model *(for separate components from the HP)*			
Exchanger			
Type			
Manufacturer			
Model			
Front area (m^2)			
Fins type/spacing (in mm)			
Fan(s)			
Number			
Trade name			
Type			
Rotation speed (rpm)			
Diameter of blades or turbine (mm)			
Number of blades/turbines			
Motor			
Manufacturer			
Reference			

5 – DATA AND CERTIFIED FEATURES FOR SINGLE UNITS AND SINGLE-SPLITS

⚠ In the case of a common application for "reversible" HPs, complete the following table for each of the two functions.

Characteristics for heating applications	**HP no. 1**	**HP no. 2**	**HP no. 3**	**HP no.….**	**HP no.….**
Reference/Model of the heat pump or combination:					
- Reference of outdoor unit					
- Reference of indoor unit					
Nature of gas heat input under nominal conditions					
Feed pressure					
Nominal voltage (in V)					
Nature of single- or three-phase current (50 Hz)					
If applicable Regulation changeover threshold LRcontmin					
Performance correction coefficient CcpLrcontmin					
The share of electrical power for the auxiliaries Ratio					
Standby power (in W)					
Temperature conditions …._…./…._….℃					
Heating capacity (in kW)					
Absorbed power (in kW)					
GUE (stated with 3 significant figures)					
Temperature conditions …._…./…._….℃					
Heating capacity (in kW)					
Absorbed power (in kW)					
GUE_h (stated with 3 significant figures)					
Temperature conditions …._…./…._….℃					
Heating capacity (in kW)					
Absorbed power (in kW)					
GUE_h (stated with 3 significant figures)					
Sound power (in dB(A), stated in 1/10th) **under the temperature conditions → …._…./…._….℃ for:** (see test diagrams)					
Outdoor side, noise radiated by the casing					
Outdoor side, global noise of openings					
Indoor side, noise radiated by the casing					
Indoor side, airborne noise in the suction ducts					
Indoor side, airborne noise in the discharge ducts					
Indoor side, airborne noise in the suction inlet and radiated noise by the casing					

Characteristics for cooling applications	**HP no. 1**	**HP no. 2**	**HP no. 3**	**HP no.….**	**HP no.….**
Reference/Model of the heat pump or combination:					
- Reference of outdoor unit					
- Reference of indoor unit					
Nature of gas heat input under nominal conditions					
Feed pressure					
Nominal voltage (in V)					
Nature of single- or three-phase current (50 Hz)					
Temperature conditions ….._…../….._…..℃					
Cooling capacity (in kW)					
Absorbed power (in kW)					
EER (stated with 3 significant figures)					
Temperature conditions ….._…../….._…..℃					
Cooling capacity (in kW)					
Absorbed power (in kW)					
GUE_c (stated with 3 significant figures)					
Temperature conditions ….._…../….._…..℃					
Cooling capacity (in kW)					
Absorbed power (in kW)					
GUE_c (stated with 3 significant figures)					
Temperature conditions ….._…../….._…..℃					
Cooling capacity (in kW)					
Absorbed power (in kW)					
GUE_c (stated with 3 significant figures)					

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CERTIFICATION REFERENCE
HEAT PUMP – NF MARK

PART 10 – APPENDIX AA
ACOUSTIC TESTS

CONTENTS

Rev 8 – August 2014

When selecting products from a heat pump range to determine the thermal performances (see Para. 3.1.3.2), just one of these products is used for the sound tests. When a heat pump range may be used either with water or water-glycol mix, the sound tests are carried out with the Glycol-Water Mix appliance. CERTITA will study the influence of the integrated options if necessary when selecting the products, together with the laboratory.

Special cases:

It is possible to test for a range of other appliances. For example for heat pumps with optional components or for multi-split heat pumps, so that each type of indoor unit can be taken into consideration.

AA.1 REFERENCE DOCUMENTS

NF EN 12102 (July 2008): Air conditioners, heat pumps and dehumidifiers with electrically driven compressors. Measurement of airborne noise. Determination of the sound power level.

NF EN ISO 3741 (November 2009): Determination of sound power levels of noise sources – Precision methods for broad-band sources in reverberation rooms.

NF EN ISO 9614-1 (November 2009): Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 1: measurements by points

AA.2 HEAT PUMP INSTALLATION CONFIGURATIONS

The system configurations are defined according to:

- the heat sources: water or air
- the HP configuration: single-unit or split
- free air discharge or ducted unit
- the location of the heat pump: indoor or outdoor installation.

An exhaustive analysis is therefore conducted, even though certain configurations may not exist on the current market.

For each of these configurations presented in a diagram, the required sound measurements are specified.

When the heat pump may be sold with a separate hydraulic kit, the kit itself is not subject to the sound tests.

For single-unit and multi-split systems (indoor air units), the sound power radiated by each type of indoor air unit (sill, wall, ceiling, etc.) is measured at high speed, in ventilation mode only (without operation of the refrigeration part). The low speed measurement may be taken at the applicant’s request and will form part of the certified features.

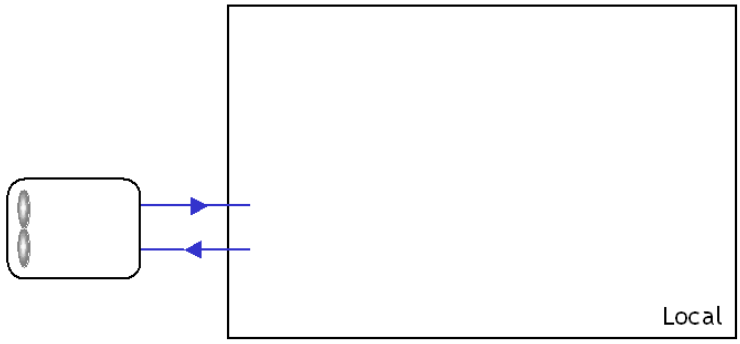
The manufacturer shall provide the laboratory with the procedure enabling the operation of the indoor unit(s) in ventilation mode only, without starting up the refrigeration circuit of the outdoor unit.

Diagram key

- water circuit: in blue
- air connection: in red
- refrigerant connection: in black

AA.2.1 OUTDOOR AIR - WATER HP

AA.2.1.1 Single unit – outdoor installation

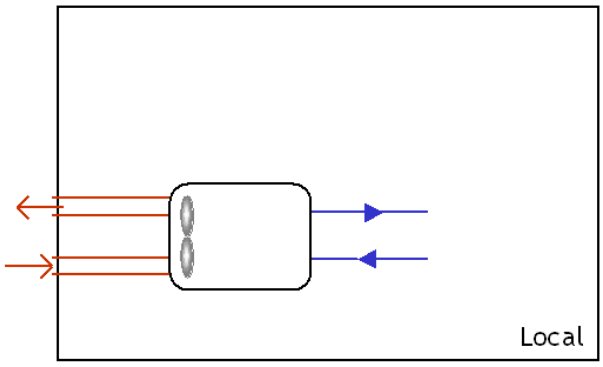


Outside: casing noise.

Inside: no measurement.

Test equipment: reverberant room or intensity method.

AA.2.1.2 Single unit – indoor installation

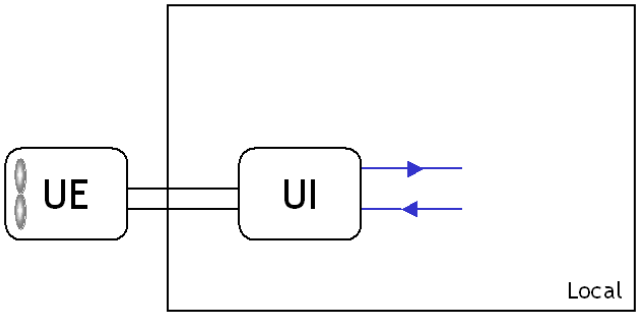


Outside: "global" noise of both air suction and discharge openings.

Inside: noise radiated by the casing.

Test equipment: double reverberant room.

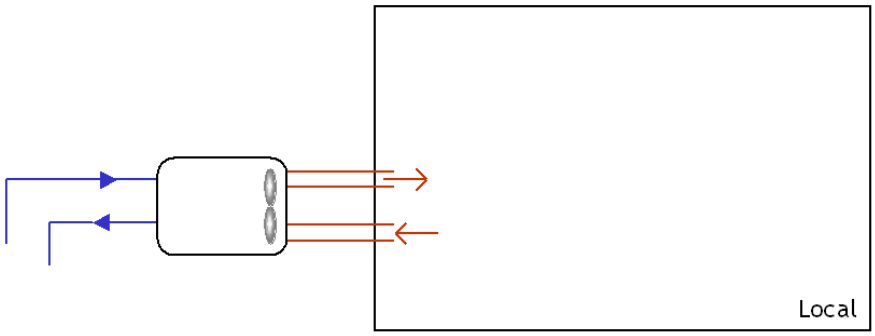
AA.2.1.3 Split system



Outside: noise radiated by the casing of the outdoor unit.
Inside: noise radiated by the casing of the indoor unit
Test equipment: double reverberant room.

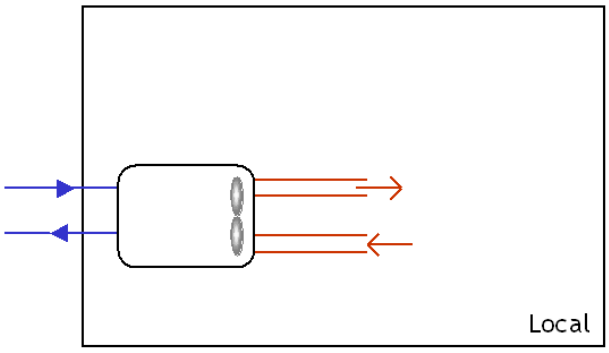
AA.2.2 WATER – RECYCLED AIR HP

AA.2.2.1 Single unit – outdoor installation



Outside: noise radiated by the casing.
Inside: global airborne noise in the suction and discharge ducts.
Test equipment: double reverberant room.

AA.2.2.2 Single unit – Indoor installation with duct to outside air

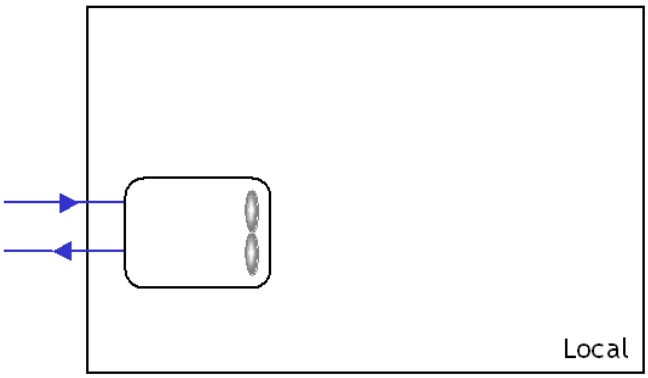


Outside: no measurement.

Inside: - Airborne noise in the suction duct.
- Airborne noise in the discharge duct.

Test equipment: Double reverberant room.

AA.2.2.3 Single unit – Indoor installation with free discharge

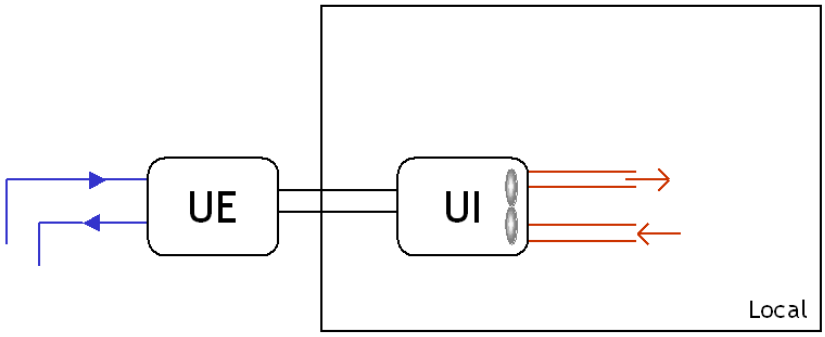


Outside: no measurement.

Inside: noise radiated by the casing.

Test equipment: reverberant room or intensity method.

AA.2.2.4 Split system with ducted indoor unit



Outside: noise radiated by the casing of the outdoor unit.

Inside (in ventilation mode only):

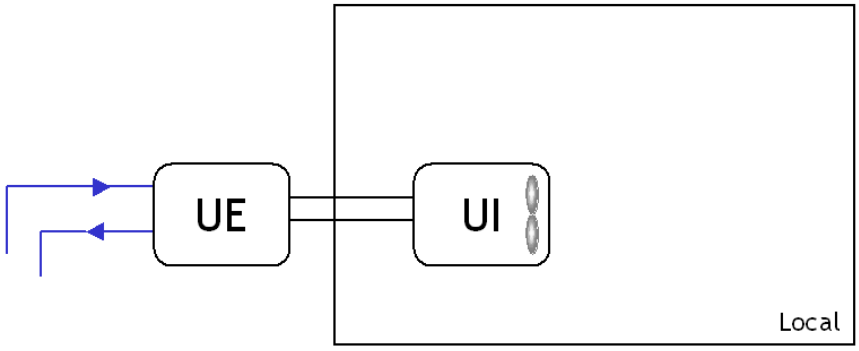
- For indoor units with suction and discharge ducts:
  - airborne noise in the suction duct,
  - airborne noise in the discharge duct.

- For indoor units with discharge ducts only:
  - airborne noise in the suction duct measured at the same time as the noise radiated by the casing.
  - airborne noise in the discharge duct.

Test equipment: double reverberant room.

NB: With a double reverberant room, during measurement of the noise radiated by the OU, the IU is fitted with its ducts, but they are not connected to a plenum. The aeraulic operating point of the IU with its ducts must be checked.

AA.2.2.5 Split with unducted indoor unit



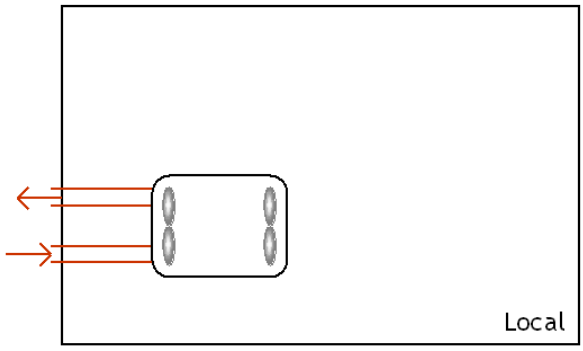
Outside: noise radiated by the casing of the outdoor unit.

Inside (in ventilation mode only): noise radiated by the indoor unit casing.

Test equipment: double reverberant room.

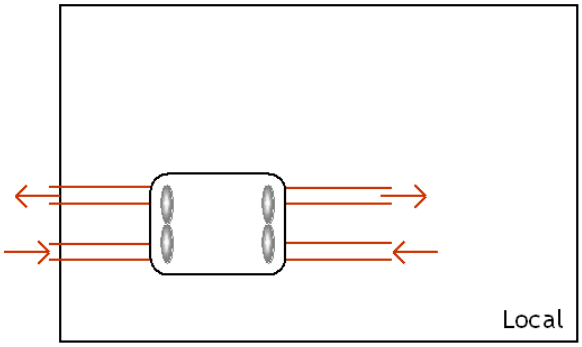
AA.2.3 OUTDOOR AIR – RECYCLED AIR HP

AA.2.3.1 Non ducted single unit – indoor installation



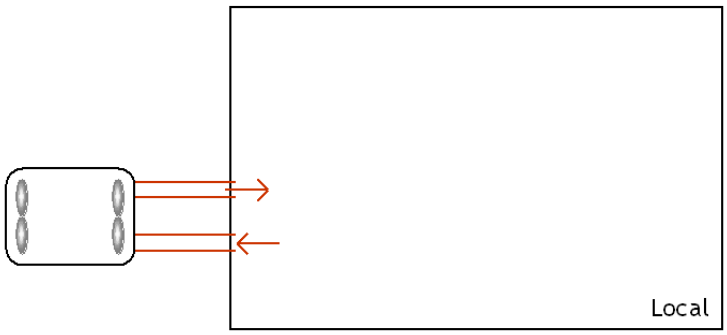
Outside: "global" noise of both air suction and discharge openings.
Inside: noise radiated by the casing.
Test equipment: double reverberant room.

AA.2.3.2 Ducted single unit – indoor installation



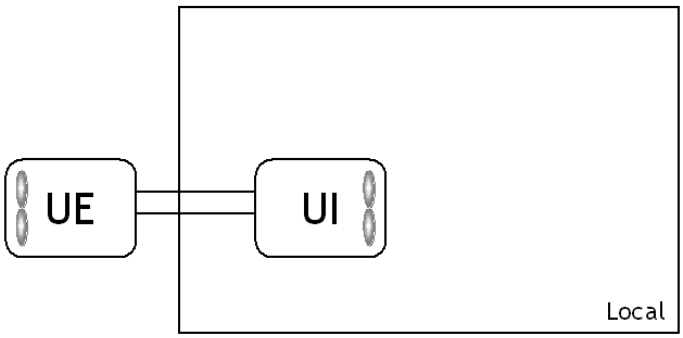
Outside: global noise of both air suction and discharge openings.
Inside: - Airborne noise in the suction duct.
- Airborne noise in the discharge duct.
Test equipment: double reverberant room.

AA.2.3.3 Ducted single unit – Outdoor installation



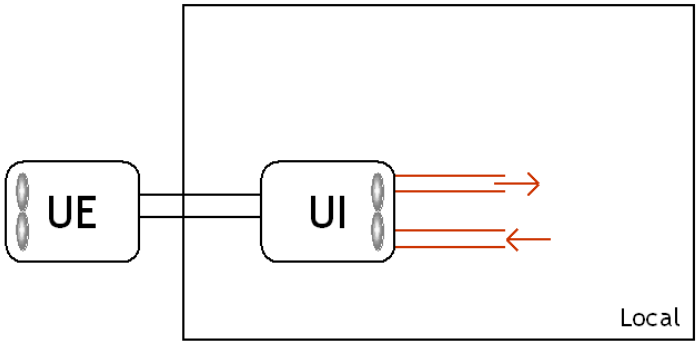
Outside: noise radiated by the casing.
Inside: airborne noise in the suction and discharge ducts.
Test equipment: double reverberant room.

AA.2.3.4 Unducted split



Outside: noise radiated by the casing of the outdoor unit.
Inside (in ventilation mode only): noise radiated by the indoor unit casing.
Test equipment: double reverberant room.

AA.2.3.5 Ducted split



Outside: noise radiated by the casing of the outdoor unit.

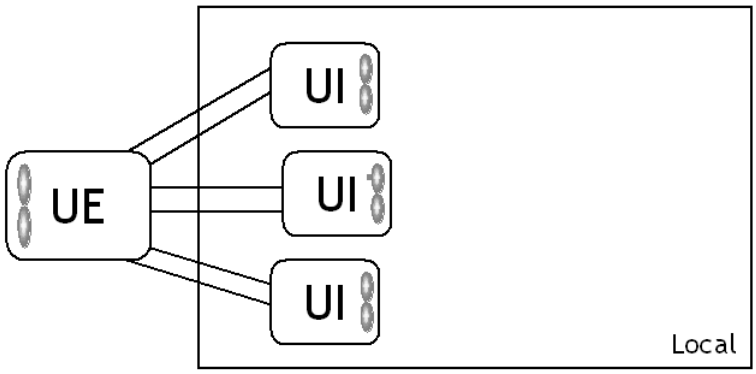
Inside (in ventilation mode only):

- For indoor units with suction and discharge ducts:
  - airborne noise in the suction duct,
  - airborne noise in the discharge duct.
- For indoor units with discharge ducts only:
  - suction noise measured at the same time as the noise radiated by the casing.
  - airborne noise in the discharge duct.

Test equipment: double reverberant room.

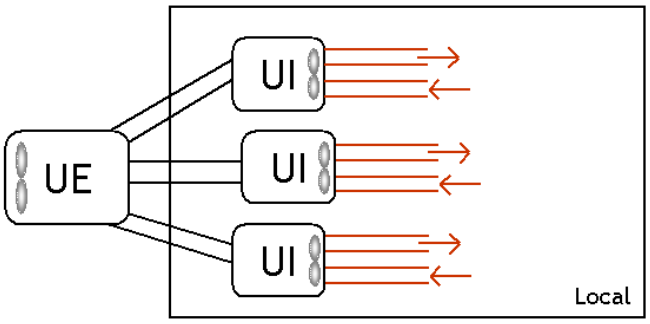
NB: With a double reverberant room, during measurement of the noise radiated by the OU, the IU is fitted with its ducts, but they are not connected to a plenum. The aeraulic operating point of the IU with its ducts must be checked.

AA.2.3.6 Multi-split system with unducted indoor units



Outside: noise radiated by the casing of the outdoor unit.
Inside (in ventilation mode only): noise radiated by the casing of each type of indoor unit.
Test equipment: double reverberant room.

AA.2.3.7 Multi-split system with ducted indoor units



This diagram shows the configuration for the OU test.

The indoor units are the same model and obviously have the same heating capacity.

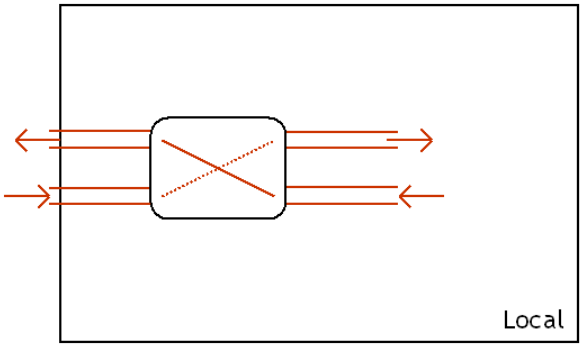
Outside: noise radiated by the casing of the outdoor unit.
Inside (in ventilation mode only):

- For indoor units with suction and discharge ducts:
  - airborne noise in the suction duct,
  - airborne noise in the discharge duct.
- For indoor units with discharge ducts only:
  - suction noise measured at the same time as the noise radiated by the casing.
  - airborne noise in the discharge duct.

Test equipment: double reverberant room.

AA.2.4 EXHAUST AIR – FRESH AIR HP

AA.2.4.1 Ducted single unit – indoor installation

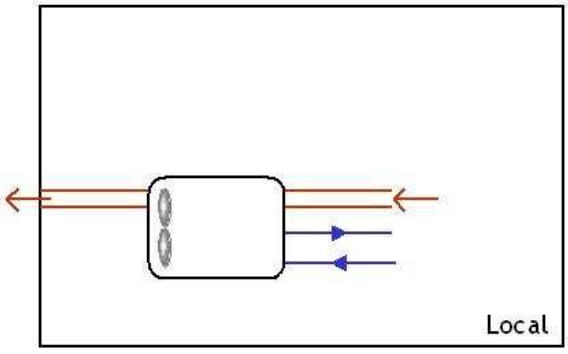


Outside: global noise of both air suction and discharge openings.
Inside: - airborne noise in the suction duct,
- airborne noise in the discharge duct.

Test equipment: double reverberant room.

NB: With a double reverberant room, when the casing noise is being measured, the ducts are connected to a small plenum and the thermal condition on the exhaust air (20°C) may not be reached.

AA.2.5 EXHAUST AIR - WATER HP



Outside: airborne noise in the discharge duct.
Inside: airborne noise in the suction duct measured at the same time as the noise radiated by the casing.
Test equipment: double reverberant room.

AA.2.6. WATER - WATER or GROUND - WATER or GROUND - GROUND HP

All the heat pumps are packaged type units and can be installed indoors or outdoors.

Outside or inside: casing noise.

Test equipment: reverberant room.

AA.2.7. GROUND - WATER HP

The installation and test configuration details are specified appendix CC.

AA.2.8 OUTDOOR AIR/GROUND CC HP

The installation and test configuration details are specified in appendix DD.

AA.3 SPECIAL INSTALLATION CONDITIONS

AA.3.1. Continuous variable capacity heat pumps

Energy performance (special test conditions)

To determine the sound power levels, the laboratory must adjust the compressor frequency to ±3 Hz and the fan rotation speed to ± 4% of the values measured during the thermal tests. If the frequency and/or speed deviation is not met, the laboratory will request that the manufacturer adjust the machine to obtain these values before undertaking the sound measurements.

Nevertheless, should it not be possible for the tolerance on the fan speed to be met by higher value, and the sound measurement result remains below the value declared by the manufacturer, increased by 2 dB, the heat pump is not refused the NF mark.

AA.3.2 Air ducting

The air coupling ducts must have the following features:

1. length of 1 m

Materials:
- rectangular duct in 12/10th or any other material of similar area density,

Or

- Circular duct: rolled galvanised duct, or any other material of similar surface density,

In all cases, the ducts must not include absorbing material on the inside,

2. Identical cross section to the HP discharge or suction cross section (generally rectangular duct for outdoor air and circular duct for recycled air).

Outside

3. the available pressure is the resulting pressure obtained with these installation characteristics
4. the ducts are not equipped with grids or terminal outlets.

If the unit and test room configuration requires the installation of elbows, priority must be given to a symmetrical configuration for the global noise measurement of the suction inlets and discharge outlets (outdoor side), with an elbow on every duct if necessary. In this case, if the total angle of a duct is greater than 90°, each elbow making it up must not exceed 90°. The total length of each duct may exceed 1m.

Inside

5. The static pressure on the indoor side is obtained by adjusting the pressure difference between the two reverberant rooms (value according to the capacity).
6. For heat pumps ducted on the two air circuits, a length of 1 m of rectangular duct shall be used for the ducting on the outdoor side. The length of the duct for the indoor side will depend on the other installation conditions such as the dimensions of the reverberant room.

The assembly of the heat pump with its ducts may be difficult to describe in the test report. In this case, the laboratory must take photos of the installation assembly, attach them to the test report and keep them in the test file.

AA.3.3 "Space heating" heat pumps

The sound tests are carried out under the chosen application conditions for the energy performances.

Regarding a range for which several applications are requested, the sound test is carried out under the conditions corresponding to the last application requested, which presents the highest temperature conditions.

For outdoor air heat pumps, the sound test is performed at an outdoor air temperature of 7(6)°C.

AA.3.4 "Swimming pool" heat pumps:

For "outdoor air-to-water" type swimming pool heat pumps, the sound test is performed at an outdoor air temperature of 15(12)°C and for the water temperature of the swimming pool heating system depending on whether the HP operates with low or high water flow.

For a heat pump range that can be installed (as it is or with optional equipment) indoors or outdoors, two test configurations are required:

Outdoor configuration: the heat pump operates without ducts, with an available pressure that is nil at discharge, and its radiated noise is measured (according to diagram § AA.2.1.1):

- Outside: casing noise
- Inside: no measurement

Indoor configuration: the HP is ducted according to § AA.3.2

If the available pressure stated by the manufacturer is ≤ 25 Pa, then the pressure available at 0 is set (see special test conditions in § A.4 or B.4). Otherwise, the available pressure is set at the maximum value Pmax supplied by the manufacturer. The following measurements are made (according to diagram § AA.2.1.2):

- Outside: "global" noise of both air suction and discharge openings
- Inside: noise radiated by the casing

AA.4 MEASUREMENT RESOLUTION

The measurement of the sound power level is stated at $1/10^{th}$ dB.

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CERTIFICATION REFERENCE
HEAT PUMP – NF MARK

PART 10 – APPENDIX BB
GROUND – GROUND HP TESTS

CONTENTS

Rev 8 – August 2014

Ground-ground type heat pumps do not fall within the scope of a standard for the determination of heat pump thermal performance.

This exclusion is related to the test method which is very different from those described in the European standard and applicable for heat pumps using air and water as heat transfer fluids.

Pending the preparation and publication of a European standard for these special appliances (CEN TC113 WG10 work), the test protocol below is applied for the certification of ground-ground heat pumps with respect to the heat pump NF mark.

BB.1 PRODUCT DESCRIPTION

Ground-ground heat pumps comprise:

- A module containing the compressor, expansion device, refrigeration accessories and regulation parts
- An evaporator: exchanger made up of a series of polyethylene coated copper tube crowns (in general).
- A condenser: exchanger made up of a series of polyethylene coated copper tube crowns (in general).

BB.2. ENERGY PERFORMANCE

The evaporator crowns are unwound on wooden supports at a height of around 1m 20 in a first climatic room. The dry temperature of this climatic room is adjusted and controlled so as to maintain the required evaporation temperature.

The evaporator crowns are unwound on wooden supports at a height of around 1m 20 in a second climatic room. The dry temperature of this climatic room is adjusted and controlled so as to maintain the required condensation temperature.

A flow meter is installed upstream of the condenser to measure the flow of liquid refrigerant. This will make it possible to calculate the condenser capacity.

Measuring the discharge pressure and liquid pressure associated with the temperatures taken at the same place enables the enthalpies of the liquid refrigerant to be determined. If the machine does not present any liquid pressure tapping, the discharge pressure will be measured to calculate both enthalpies.

The module is installed in an environment at room temperature.

The manufacturer's qualified personnel connect the evaporator and condenser crowns to the module and load with liquid refrigerant.

Instruments include:

- an electrical meter upstream of the machine general power supply
- pressure sensors to measure the suction and discharge pressures and liquid pressure where applicable
- Contact probes (PT100) to measure the discharge, liquid and suction temperatures.

The water temperature measurement uncertainty also applies to the measurement of liquid refrigerant temperatures.

The tolerances admitted on the evaporation and condensation temperatures are given in the table below:

	Admissible deviation on the arithmetic mean from the set-point value	Admissible deviation on the individual values from the set-point value
Liquid refrigerant temperature	± 0.2 K	(*)

(*) : the test method has a significant influence on the machine operating stability during testing. This value is thus inherent to the machine. Therefore, it cannot be quantified.

The heating capacity of the condenser is calculated with the formula:

$$Pf_{cond} = qm_{ff} * (h_{ref} - h_{liq})$$

Where: qm_{ff} = flow of liquid refrigerant in kg/s
h_{ref} = enthalpy corresponding to the discharge pressure in kJ/kg
h_{liq} = enthalpy corresponding to the liquid temperature in kJ/kg

The COP is calculated as follows:

$$COP = Pf_{Cond} / Pelec$$

Where: Pf_{Cond} in kW
Pelec in kW

BB.3. SOUND PERFORMANCE

The sound tests are conducted in a reverberant room according to standard NF EN ISO 3741: *"Determination of sound power levels of noise sources – Precision methods for broad-band sources in reverberation rooms."* under the nominal thermal conditions.

They involve measuring the sound power levels by one-third octave bands between 100 and 10,000 Hz as well as the A weighted global sound power level.

BB.3.1 Operating conditions

The tests only cover the HP module.

The test conditions are those described in appendices A and B of this reference standard.

In the case of tests according to the two applications for the ground-water heat pumps, the test conditions of the “fan-convector” application are selected for the sound test.

BB.3.2 Installation and test methods

The module is placed in a reverberant room. The evaporator crowns are replaced by a water exchanger placed in a second reverberant room.

The condenser is connected to a water circuit with controlled flow rate and temperature. The same suction pressure/temperature as that obtained at the thermal point is set, as well as the same liquid temperature.

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HEAT PUMP – NF MARK

PART 10 – APPENDIX CC
WATER – GROUND HP TESTS

CONTENTS

Rev 8 – August 2014

Water-ground type heat pumps do not fall within the scope of a standard for the determination of heat pump thermal performance.

This exclusion is related to the test method which is very different from those described in the European standard and applicable for heat pumps using air and water as heat transfer fluids.

Pending the preparation and publication of a European standard for these special appliances (CEN TC113 WG10 work), the test protocol below is applied for the certification of ground-ground heat pumps with respect to the heat pump NF mark.

CC.1 PRODUCT DESCRIPTION

The outdoor exchanger (evaporator) is connected to the water, while the condenser is placed directly in the ground of the indoor environment.

A Ground-Water heat pump may be of different types:

- single-unit: the compressor, expansion device and water exchanger are within the same body (a single module), with the condenser crowns separate of course,
- split: the compressor and/or expansion device and/or water exchanger are not within the same body (several modules), and the condenser crowns are of course separate.

CC.2. ENERGY PERFORMANCE

The module(s) is(are) installed in an environment at room temperature and connected to a water loop enabling the required water conditions to be maintained.

The condenser crowns are unwound on wooden supports at a height of around 1.20 m in a climatic room. The dry temperature of this climatic room is adjusted so as to maintain the required condensation temperature.

A flow meter is installed upstream of the condenser to measure the flow of liquid refrigerant. This will make it possible to calculate the condenser capacity. Loops are made at each end of the flow meter to reduce vibration phenomena of the discharge pipes.

Note: The flow meter will be assembled, as far as possible, in the same environment at room temperature as the module(s).

Otherwise, the liquid refrigerant condensation pressure is measured at the compressor discharge and downstream of the crown outlet collector. Should the machine not present any pressure tapping at these points, the condensation pressure will be measured at the flow meter (placed by the laboratory upstream of the crown inlet collector). This value will also be referred to as the floor outlet pressure measurement (and the loss of load of the condenser crowns will therefore be overlooked).

The liquid refrigerant temperatures are measured upstream of the crown inlet collector (floor inlet) and downstream of the crown collector (floor outlet), with consideration of the heating capacity transmitted in the floor only.

The manufacturer's qualified personnel connect the condenser crowns to the module(s) and load with liquid refrigerant.

The following quantities are measured during the test:

- compressor suction pressures and floor collector inlet and outlet pressures (if available, otherwise see above),
- compressor suction temperatures, floor collector inlet and outlet temperatures,
- liquid refrigerant flow,
- water inlet and outlet temperatures,
- loss of load or pressure available on the water,
- water flow,
- electrical power absorbed,
- liquid refrigerant load and type of liquid.

The tolerances admitted on the condensation temperatures are given in the table below:

	Admissible deviation on the arithmetic mean from the set-point value	Admissible deviation on the individual values from the set-point value
Liquid refrigerant temperature	± 0.3 K	(*)

(*) : the test method has a significant influence on the machine operating stability during testing. This value is thus inherent to the machine. Therefore, it cannot be quantified.

The heating capacity of the condenser is calculated with the formula:

$$Pf_{cond} = qm_{ff} * (h_{ent} - h_{sort})$$

Where: qm_{ff} = flow of liquid refrigerant in kg/s

h_{ent} = enthalpy corresponding to the floor inlet pressure in kJ/kg

h_{sort} = enthalpy corresponding to the floor outlet temperature in kJ/kg

The COP is calculated as follows:

$$COP = \frac{Pf_{cond}}{Pelec}$$

Where: Pf_{Cond} in kW

Pelec in kW

CC.3. SOUND PERFORMANCE

The sound tests are conducted in a reverberant room according to standard NF EN ISO 3741: *"Determination of sound power levels of noise sources – Precision methods for broad-band sources in reverberation rooms."* under the nominal thermal conditions.

They involve measuring the sound power levels by one-third octave bands between 100 and 10,000 Hz as well as the A weighted global sound power level.

CC.3.1 Operating conditions

The tests are only conducted on the heat pump module, comprising at least the compressor.

The test conditions are those described in appendices A and B of this reference standard.

CC.3.2 Installation and test methods

The module is placed in a reverberant room.

The condenser crowns are replaced by a water exchanger placed in a second, adjacent reverberant room and connected to a water loop with set temperature and flow. The same floor inlet and outlet pressures/temperatures are therefore set as those obtained during the thermal test.

The evaporator is connected to a water circuit with controlled temperature and flow to set the test conditions.

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CERTIFICATION REFERENCE

HEAT PUMP – NF MARK

PART 10 – APPENDIX DD

OUTDOOR AIR – GROUND HEAT PUMP TESTS

CONTENTS

Rev 8 – August 2014

Water-ground type heat pumps do not fall within the scope of a standard for the determination of heat pump thermal performance.

This exclusion is related to the test method which is very different from those described in the European standard and applicable for heat pumps using air and water as heat transfer fluids.

Pending the preparation and publication of a European standard for these special appliances (CEN TC113 WG10 work), the test protocol below is applied for the certification of ground-ground heat pumps with respect to the heat pump NF mark.

DD.1 PRODUCT DESCRIPTION

An Air/Ground heat pump may be of different types:

- single-unit: the compressor, expansion device and air exchanger are within the same body (a single module), with the condenser crowns separate of course,
- split: the compressor and/or expansion device and/or air exchanger are not within the same body (several modules), and the condenser crowns are of course separate.

DD.2. ENERGY PERFORMANCE

The air exchanger module is installed in a climatic room in which the dry and wet temperatures are set and controlled so as to maintain the required conditions.

For a split machine, module(s) other than the air exchanger are installed at room temperature.

The condenser crowns are unwound on wooden supports at a height of around 1.20 m in a climatic room. The dry temperature of this climatic room is adjusted so as to maintain the required condensation temperature.

A flow meter is installed upstream of the condenser to measure the flow of liquid refrigerant. This will make it possible to calculate the condenser capacity. Loops are made at each end of the flow meter to reduce vibration phenomena of the discharge pipes.

Note: The flow meter will be assembled, wherever possible, in an environment at room temperature.

Otherwise, the liquid refrigerant condensation pressure is measured at the compressor discharge and downstream of the crown outlet collector. Should the machine not present any pressure tapping at these points, the condensation pressure will be measured at the flow meter (placed by the CETIAT upstream of the crown inlet collector). This value will also be referred to as the floor outlet pressure measurement (and the loss of load of the condenser crowns will therefore be overlooked).

The liquid refrigerant temperatures are measured upstream of the crown inlet collector (floor inlet) and downstream of the crown collector (floor outlet), with consideration of the heating capacity transmitted in the floor only.

The manufacturer’s qualified personnel connect the condenser crowns to the module(s) and load with liquid refrigerant.

The following quantities are measured during the test:

- compressor suction pressures and floor collector inlet and outlet pressures (if available, otherwise see above),
- compressor suction temperatures, floor collector inlet and outlet temperatures,
- liquid refrigerant flow,
- incoming dry and wet temperatures of the evaporator on the air,
- rotation speed of the fan(s),
- electrical power absorbed,
- liquid refrigerant load and type of liquid.

The tolerances admitted on the condensation temperatures are given in the table below:

	Admissible deviation on the arithmetic mean from the set-point value	Admissible deviation on the individual values from the set-point value
Liquid refrigerant temperature	± 0.3 K	(*)

(*) : the test method has a significant influence on the machine operating stability during testing. This value is thus inherent to the machine. Therefore, it cannot be quantified.

The heating capacity of the condenser is calculated with the formula:

$$Pf_{cond} = qm_{ff} * (h_{ent} - h_{sort})$$

Where: qm_{ff} = flow of liquid refrigerant in kg/s

h_{ent} = enthalpy corresponding to the floor inlet pressure in kJ/kg

h_{sort} = enthalpy corresponding to the floor outlet temperature in kJ/kg

The COP is calculated as follows:

$$COP = \frac{Pf_{cond}}{Pelec}$$

Where: Pf_{Cond} in kW

Pelec in kW

DD.3. SOUND PERFORMANCE

The sound tests are conducted in a reverberant room according to standard NF EN ISO 3741: *"Determination of sound power levels of noise sources – Precision methods for broad-band sources in reverberation rooms."* under the nominal thermal conditions.

They involve measuring the sound power levels by one-third octave bands between 100 and 10,000 Hz as well as the A weighted global sound power level.

DD.3.1 Operating conditions

The tests are only conducted on the heat pump module(s) containing the compressor and air evaporator.

The test conditions are those described in appendices A and B of this reference standard.

DD.3.2 Installation and test methods

The module is placed in a reverberant room.

The condenser crowns are replaced by a water exchanger placed in a second, adjacent reverberant room and connected to a water loop with set temperature and flow. The same floor inlet and outlet pressures/temperatures are therefore set as those obtained during the thermal test.

The air evaporator is placed in a reverberant room with temperature control so as to set the desired atmospheric conditions.

If the compressor is integrated in the same module, a single sound power measurement is made.

If the compressor is placed in another module, it is installed in the adjacent reverberant room with the water loop simulating the condenser crowns.

Both the sound power measurements of the evaporator and compressor are then made at the same time.

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HEAT PUMP – NF MARK

PART 10 – APPENDIX EE

GAS HP TESTS

Rev 8 – August 2014

1. INTRODUCTION

This document describes the test methods for gas-fired heat pumps (engine-driven and absorption). This protocol is only applicable within the scope of the future NF GAS HP mark.

2. BRIEF DESCRIPTION OF APPLIANCES CONCERNED

2.1. Engine-driven HPs

Most engine-driven HPs comprise the same thermodynamic components as an electrically driven HP. The only changes are:

- The compressor drive type. Indeed, engine-driven HPs drive the HP compressor by means of a gas-fired internal combustion engine.
- The optional insertion of a specific water/liquid coolant exchanger which may be incorporated in this type of appliance to "recycle" the cooling heat.

2.2. Gas-fired absorption HPs

The thermodynamic cycle associated with absorption does not involve strictly the same components as HPs with electrically driven compressors. Apart from the refrigerant, the following three components are common to electrically driven and gas absorption HPs:

- the condenser which transfers heat to the space to be heated (directly or via a heat transfer fluid),
- the refrigerant expansion system,
- the evaporator which extracts heat from its environment

In absorption HPs, the mechanical compressor is replaced by a thermochemical compression system, requiring the use of a binary mixture including a refrigerant and an absorbent. This thermochemical compression system essentially comprises:

- a boiler (sometimes referred to as a generator), heated by a gas-fired burner,
- at least one absorbent expansion valve between the boiler and the absorber,
- an absorber,
- a solution circulation pump, if applicable

The combustion product discharge circuit may be equipped with a flue gas heat recovery exchanger, suitable for condensing the water vapour contained therein.

3. DEFINITION OF PARAMETERS AND QUANTITIES SUBJECT TO CERTIFICATION AND EVALUATION

3.1. Effective electric power P_E

The effective electric power consists of the mean electric power absorbed by the appliance during the defined time interval. It consists of:
- the electric power absorbed for compressor operation for engine-driven HPs or for the operation of the boiler/absorber/solution pump assembly for absorption HPs and any electric power absorbed by defrosting, along with the power absorbed by all the control and safety devices of the appliance (P);
- the share of power of the devices (e.g. fans, pumps) providing circulation of the heat transfer fluids inside the appliance.

Tables 1 to 4 show the calculation formulas for P_E according to the type of appliance.

3.2. Heating capacity P_H

The heating capacity of air/air or liquid/air heat pumps and the cooling capacity, if they are reversible, should be determined by means of room calorimeter measurements or by the enthalpy method for air described in Annex A and in Annex B of the NF EN 14511-3 :2011 standard, respectively.

The heating capacity of air/liquid, liquid/liquid heat pumps and the cooling capacity, if they are reversible, should be determined according to the direct method on the heat exchanger in contact with the heat transfer fluid (water or glycol water), by determining the volume flow rate of the heat transfer fluid, and the inlet and outlet temperatures, according for the specific heat and density of the heat transfer fluid.

The heating capacity should be determined using the following formula:

$$P_H = \frac{\sum_{j=1}^{n} (q_j * \rho_j * Cp_j * \Delta t_j)}{n} \qquad (1)$$

where

j is the sample number;

n is the number of samples during the data acquisition period;

P_H is the heating capacity, expressed in Watts;

q_j is the volume flow rate of the heat transfer fluid for the sample in question, expressed in cubic metres per second;

ρ_j is the density of the heat transfer fluid at the measurement temperature for the sample in question, expressed in kilograms per cubic metre;

c_{pj} is the specific heat at constant pressure corresponding to the mean temperature of the heat transfer fluid for the sample in question, expressed in Joules per kilogramme-kelvin;

Δt_j is the inlet-outlet temperature differential for the sample in question, expressed in kelvin.

Note 1: The water mass flow rate can be measured directly as a substitute for the term ($\rho * q$)

Note 2: The enthalpy differential can also be used as a substitute for the term ($c_p \Delta t$)

3.3. Effective heating capacity Q_{EH}

The effective heating capacity consists of the mean heating capacity reproduced on the inside circuit by the appliance during the defined time interval when the appliance is supplied with a reference gas from the gas category covering the appliance under reference conditions (dry gas, 15°C, 1013.25 mbar).

It consists of:

- the heating capacity P_H corrected for the effect of the test gas actually used;
- the share of power of the devices providing circulation of the heat transfer fluids inside the appliance (e.g.: fans, pumps).

The correction to be applied to the heating capacity P_H to obtain the effective heating capacity is given by the following formula:

$$Cgaz = \frac{Qgnh}{Qgmh} \qquad (2)$$

where

Qgnh is the nominal gas heat input in heating mode

Qgmh is the gas heat input

Tables 1 to 3 show the calculation formulas for Q_{EH} according to the type of appliance.

Appliance type	Electrical component for outdoor exchanger fluid circulation	Electrical component for indoor exchanger fluid circulation	Heating capacity (effective) Q_{EH}	Electric power (effective) P_E
Ductless air/liquid	The fan is integrated in the appliance	The pump is integrated in the appliance	$Q_{EH} = P_{EH} - c_{indoor}$	$P_E = P - c_{indoor}$
		The pump is not integrated in the appliance	$Q_{EH} = P_{EH} + c_{indoor}$	$P_E = P + c_{indoor}$
Ducted air/liquid	The fan is integrated in the appliance	The pump is integrated in the appliance	$Q_{EH} = P_{EH} - c_{indoor}$	$P_E = P - c_{indoor} - c_{outdoor}$
		The pump is not integrated in the appliance	$Q_{EH} = P_{EH} + c_{indoor}$	$P_E = P + c_{indoor} - c_{outdoor}$
	The fan is not integrated in the appliance	The pump is integrated in the appliance	$Q_{EH} = P_{EH} - c_{indoor}$	$P_E = P - c_{indoor} + c_{outdoor}$
		The pump is not integrated in the appliance	$Q_{EH} = P_{EH} + c_{indoor}$	$P_E = P + c_{indoor} + c_{outdoor}$

Table 1 – Q_{EH} and P_E for Air/liquid appliances

Appliance type	Electrical component for outdoor exchanger fluid circulation	Electrical component for indoor exchanger fluid circulation	Heating capacity (effective) Q_{EH}	Electric power (effective) P_E
Ductless air / Ductless air	The fan is integrated in the appliance	The fan is integrated in the appliance	$Q_{EH} = C_{gaz} * P_H$	$P_E = P$
Ductless air / Ducted air	The fan is integrated in the appliance	The fan is integrated in the appliance	$Q_{EH} = C_{gaz} * P_H - c_{indoor}$	$P_E = P - c_{indoor}$
		The fan is not integrated in the appliance	$Q_{EH} = C_{gaz} * P_H + c_{indoor}$	$P_E = P + c_{indoor}$
Ducted air / Ducted air	The fan is integrated in the appliance	The fan is integrated in the appliance	$Q_{EH} = C_{gaz} * P_H$	$P_E = P - c_{outdoor}$
	The fan is not integrated in the appliance		$Q_{EH} = C_{gaz} * P_H$	$P_E = P + c_{outdoor}$
Ducted air/Ducted air	The fan is integrated in the appliance	The fan is integrated in the appliance	$Q_{EH} = C_{gaz} * P_H + c_{indoor}$	$P_E = P - c_{indoor} - c_{outdoor}$
		The fan is not integrated in the appliance	$Q_{EH} = C_{gaz} * P_H - c_{indoor}$	$P_E = P + c_{indoor} - c_{outdoor}$
	The fan is not integrated in the appliance	The fan is integrated in the appliance	$Q_{EH} = C_{gaz} * P_H + c_{indoor}$	$P_E = P - c_{indoor} + c_{outdoor}$
		The fan is not integrated in the appliance	$Q_{EH} = C_{gaz} * P_H - c_{indoor}$	$P_E = P + c_{indoor} + c_{outdoor}$

Table 2 - Q_{EH} and P_E calculation for Air/Air appliances

Appliance type	Electrical component for outdoor exchanger fluid circulation	Electrical component for indoor exchanger fluid circulation	Heating capacity (effective) Q_{EH}	Electric power (effective) P_E
Liquid/Liquid	The pump is integrated in the appliance	The pump is integrated in the appliance	$Q_{EH} = C_{gaz} * P_H - c_{indoor}$	$P_E = P - c_{indoor} - c_{outdoor}$
		The pump is not integrated in the appliance	$Q_{EH} = C_{gaz} * P_H + c_{indoor}$	$P_E = P + c_{indoor} - c_{outdoor}$
	The pump is not integrated in the appliance	The pump is integrated in the appliance	$Q_{EH} = C_{gaz} * P_H - c_{indoor}$	$P_E = P - c_{indoor} + c_{outdoor}$
		The pump is not integrated in the appliance	$Q_{EH} = C_{gaz} * P_H + c_{indoor}$	$P_E = P + c_{indoor} + c_{outdoor}$

Table 3 - Q_{EH} and P_E calculation for Liquid/Liquid appliances

3.4. Heat recovery capacity P_{Ehr} (evaluated quantity)

The heat recovery capacity, in both heating and cooling mode should be determined according to the direct method on the heat exchanger in contact with the heat transfer fluid (water or glycol water), by determining the volume flow rate of the heat transfer fluid, and the inlet and outlet temperatures, according for the specific heat and density of the heat transfer fluid.
The heating capacity should be determined using the following formula:

$$P_{Ehr} = \frac{\sum_{j=1}^{n} (q_j * \rho_j * Cp_j * \Delta t_j)}{n} \quad (3)$$

where

j is the sample number;

n is the number of samples during the data acquisition period;

P_{Ehr} is the heat recovery capacity, expressed in Watts;

q_j is the volume flow rate of the heat transfer fluid for the sample in question, expressed in cubic metres per second;

ρ_j is the density of the heat transfer fluid at the measurement temperature for the sample in question, expressed in kilograms per cubic metre;

c_{pj} is the specific heat at constant pressure corresponding to the mean temperature of the heat transfer fluid for the sample in question, expressed in Joules per kilogramme-kelvin;

Δt_j is the inlet-outlet temperature differential for the sample in question, expressed in kelvin.

Note 1: The water mass flow rate can be measured directly as a substitute for the term ($\rho_j * q_j$).

Note 2: The enthalpy differential can also be used as a substitute for the term ($c_{pj}\,\Delta t_j$).

3.5. Effective heat recovery capacity Q_{Ehr} (evaluated quantity)

The effective heat recovery capacity Q_{Ehr} consists of the mean heat recovery capacity reproduced on the inside circuit by the appliance during the defined time interval when the appliance is supplied with a reference gas from the gas category covering the appliance under reference conditions (dry gas, 15°C, 1013.25 mbar).

It consists of:
- the heat recovery capacity P_{Ehr} *corrected for the effect of the test gas actually used*;
- the share of power of the pump providing circulation of the heat transfer fluid in the heat recovery circuit.

The correction to be applied to the heat recovery capacity P_{Ehr} *to obtain the* effective heat recovery capacity *QEhr* is given by formula no. 2 (see § 3.3).

Table 4 shows the calculation formulas for Q_{Ehr} according to the type of appliance.

Appliance type	**Electrical component for recovery exchanger heat transfer fluid circulation**	**Effective heat recovery capacity Q_{Ehr}**
All appliance types	A recovery circuit pump is integrated in the appliance	$Q_{Ehr} = C_{gaz} * P_{Ehr} - c_{hr}$
	A recovery circuit pump is not integrated in the appliance	$Q_{Ehr} = C_{gaz} * P_{Ehr} + c_{hr}$

Table 4 – Q_{Ehr} calculation

3.6. Cooling capacity Q_F, effective cooling capacity Q_{EF}

The procedure for calculating the heating and effective heating capacities should be applied to the cooling and effective cooling capacities, respectively, of reversible HPs in the case of operation in cooling mode.

3.7. Gas heat input in heating mode Q_{gmh}

The gas heat input under the test conditions should be determined using one of the following formulas:

$$Q_{gmh} = 278 \cdot \frac{\sum_{j=1}^{n} (Mh_j * H_{iM(T)j})}{n} \qquad (4)$$

or

$$Q_{gmh} = 278 \cdot \frac{\sum_{j=1}^{n} (Vh_j * H_{iV(T)j})}{n} \qquad (5)$$

where:

j is the sample number;

n is the number of samples during the data acquisition period;

Q_{gmh} is the heat input measured in heating mode, in Watts;

$H_{iM(T)j}$ is the net calorific value by mass of the test gas for the sample in question, in Megajoules per kilogram;

Mh_j is the gas mass flow rate in heating mode for the sample in question, in kilograms per hour;

$H_{iV(T)j}$ is the net calorific value by volume of the test gas for the sample in question, in Megajoules per cubic metre (dry gas, expressed at 15°C, 1013.25 mbar);

Vh_j is the volume flow rate of the dry gas with reference to 1013.25 mbar and 15°C in heating mode for the sample in question, in cubic metres per hour, determined using the following formula:

$$Vh_j = V_{mj} \cdot \frac{p_{aj} + p_j - p_{wj}}{1013{,}25} \cdot \frac{288{,}15}{273{,}15 + t_{gj}} \qquad (6)$$

where:

V_{mj} is the gas volume flow measured in heating mode for the sample in question, in cubic metres per hour;

p_{aj} is the atmospheric pressure for the sample in question, in millibar;

pj is the gas feed pressure at the meter for the sample in question, in millibar;

p_{wj} in the partial water vapour pressure in the gas for the sample in question, in millibar;

t_{gj} is the temperature of the gas at the meter for the sample in question, in degrees Celsius.

NOTE 1 It is important to note that the gas pressure on the flow meter may be different to the gas feed pressure of the appliance under test.

3.8. Nominal gas heat input in heating mode Qgnh

The nominal gas heat input should be determined using one of the following formulas:

$$Q_{gnh} = 278 \cdot \frac{\sum_{j=1}^{n} M_0 h_j}{n} * H_{iM} \qquad (7)$$

Where

$$Q_{gnh} = 278 \cdot \frac{\sum_{j=1}^{n} V_0 h_j}{n} * H_{iV} \qquad (8)$$

Q_{gnh} is the nominal heat input in heating mode, in Watts;

$M_0 h_j$ is the mass flow rate of the reference gas under the reference conditions (dry gas, 15°C, 1 013,25 mbar) in heating mode, in Megajoules per kilogram, determined using the following formula;

$$M_0h_j = Mh_j \cdot * \sqrt{\frac{1013{,}25 + P_j}{P_{aj} + P_j} * \frac{273{,}15 + tg_j}{288{,}15} * \frac{dr}{d}} \qquad (9)$$

where

Mh_j is the gas heat input measured in heating mode for the sample in question, in kilograms per hour;

p_{aj} is the atmospheric pressure for the sample in question, in millibar;

p_j is the gas feed pressure at the meter for the sample in question, in millibar;

p_{wj} is the partial water vapour pressure in the gas for the sample in question, in millibar;

t_{gj} is the temperature of the gas at the meter for the sample in question, in degrees Celsius:

dr *is the density of the reference gas with respect to dry air;*

d *is the density of the dry gas used with respect to dry air;*

H_{iM} is the net calorific value by mass of the reference gas under reference conditions (dry gas, 150C, 1013.25 mbar);

V_0h_j is the volume flow rate of the reference gas under the reference conditions (dry gas, 15°C, 1 013,25 mbar) determined using the following formula;

$$V_0h_j = Vh_j \cdot * \sqrt{\frac{1013{,}25 + P_j}{1013{,}25} * \frac{P_{aj} + P_j}{1013{,}25} * \frac{288{,}15}{273{,}15 + tg_i} * \frac{d}{dr}} \qquad (10)$$

H_iv is the net calorific value by volume of the reference gas under reference conditions (dry gas, 15°C, 1013.25 mbar);

3.9. Gas heat input and nominal heat input in cooling mode

The procedure for calculating the gas heat input and nominal heat input in heating mode should be applied for calculating the gas heat input and nominal heat input, respectively, of reversible HPs when operating in cooling mode.

This parameter is referred to as Q_{gnc}

3.10. Gas utilisation efficiency in heating mode GUE_h

The gas utilisation efficiency, for HP tests in heating mode, is determined using the following equation:

$$GUE_h = \frac{Q_{Eh}}{Q_{gmh}} \qquad (11)$$

where:

GUE_h is the gas utilisation efficiency;

Q_{Eh} is the effective heating capacity, in Watts;

Q_{gmh} is the gas heat input, in Watts.

3.11. Gas utilisation efficiency in cooling mode

The procedure for calculating the gas utilisation efficiency in heating mode should be applied for calculating the gas utilisation efficiency of reversible HPs when operating in cooling mode.
This parameter is referred to as GUE_c with the following equation:

$$GUE_c = \frac{Q_{Ec}}{Q_{gmc}} \qquad (12)$$

where:

GUE_c is the gas utilisation efficiency in cooling mode;

Q_{Ec} is the effective cooling capacity, in Watts;

Q_{gmc} is the gas heat input, in Watts.

4. TEST SET-UP

4.1. Test set-up requirements

4.1.1. General requirements

The test set-up should be designed to comply with all set-point value setting requirements, stability criteria and measurement uncertainties in accordance with this procedure.

4.1.2. Feed gas requirements

The tests should be conducted with one of the suitable reference gases for the category covering the appliance (see the NF EN 437 standard), under the normal pressure specified in the NF EN 437 standard.
Before testing, the heat input of the burner(s) is set, if required, to be equal to the nominal heat input ± 5%.

This nominal heat input is set when the appliance is operating under the nominal conditions according to the standard.

4.1.3. Test chamber requirements at air end

The dimensions of the test chamber should be selected to avoid any obstacles to air circulation at the air inlet and outlet openings of the test appliance. The air flow rate in the chamber should not give rise to short-circuiting between the two openings; as a result, the air velocity in the chamber at these two openings should not exceed 1.5 m/s when the test appliance is not operating. Moreover, the air velocity in the chamber should not exceed the mean velocity at the appliance inlet. Unless specified otherwise by the manufacturer, the air inlet and outlet openings should be situated at least 1 m from the walls of the test chamber.
Any direct radiation of heat from the test chamber heating equipment to the appliance or to the temperature measurement points should be prevented.

4.1.4. Ducted appliances

The ducted appliance set-up should be sufficiently air-tight to prevent the measurement results from being influenced significantly by air exchange with the environment.

4.1.5. Appliances with integrated pumps

For appliances with adjustable and incorporated water or glycol water pumps, the external static pressure should be set at the same time as the temperature differential, according to the protocol specified below.

4.2. Test appliance set-up and connection

4.2.1. General

The test appliance should be set up and connected for the test as recommended by the manufacturer in the installation and operating manual. Accessories supplied as an option (e.g. supplementary electric heater) are not included in the test.

4.2.2. Set-up of appliances with separate components

In the case of appliances with separate components, the following set-up conditions should be observed for the tests:

a) the refrigeration connections should be fitted in accordance with manufacturer instructions with a minimum length of 5 m and a maximum length of 7.5 m if test set-up restrictions do not allow a length of 5 m;

b) the connections should be fitted such that the difference in elevation does not exceed 2.5 m;

c) the refrigeration connections should be thermally insulated in accordance with manufacturer instructions;

d) unless restricted for design reasons, at least half of the refrigeration connections should be exposed to outside conditions, with the remainder exposed to inside conditions.

4.2.3. Measurements

The temperature and pressure measurement points should be distributed so as to obtain significant mean values.

Free air inlet temperature measurements require the following:

- at least one sensor per square metre with at least four measurement points, restricting the number of sensors distributed evenly on the air surface to 20;
- or the use of a sampling device. It should be supplemented with four sensors to check uniformity if the surface area is greater than 1 m^2.

The air temperature sensors should be positioned at a maximum distance of 0.25 m from the free air surface (e.g.: 25 cm from the outside exchanger in the case of a ductless Air/liquid HP).

NOTE 1 It should be noted that, for appliances using a liquid as the inside heat transfer fluid, a temperature measurement should be made at the water meter.

5. MEASUREMENT UNCERTAINTIES

The measurement uncertainties should not exceed the values specified in Table 5.

Quantity measured	Unit	Measurement uncertainty
Liquid (water or glycol water)		
- inlet/outlet temperature	ºC	± 0.15 K
- temperature differential	K	± 0.21 K
- flow rate (volume or mass)	m^3/s or kg/s	± 1 %
- static pressure differential	Pa	5 %
Air		
- dry bulb temperature	ºC	± 0.2 K
- wet bulb temperature	ºC	± 0.4 K
- flow rate (volume)	m^3/s	± 5 %
- static pressure differential	Pa	± 5 Pa (p ≤ 100 Pa) or 5% (p >100 Pa)
Concentration		
- heat transfer fluid	%	± 2 %
Heat input		
- atmospheric pressure	mbar	± 5 mbar
- gas pressure	mbar	± 2% full scale without exceeding 0.5 mbar
- gas flow rate	m^3/h or kg/h	± 1 %
- gas temperature	°C	± 0.5 K
- calorific value	MJ/m^3	± 1%
Electrical quantities		
- electric power	W	± 1 %
- voltage	V	± 0.5 %
Time	s	± 0.2 s to 1 hr ± 0.1% after 1 hr

Table 5 – Measurement uncertainties on specified values

The heating capacity measured at the liquid end should be determined with a maximum uncertainty equivalent to the maximum between 5% and ($20.5*\delta T^{-0,89}$), regardless of the individual measurement uncertainties, including fluid property uncertainties.

The heating capacity in stabilised mode determined using the calorimetric method should be determined with a maximum uncertainty of 5%, regardless of the individual measurement uncertainties, including fluid property uncertainties.
The gas heat input should be determined with a maximum uncertainty of 2%, regardless of the individual measurement uncertainties, including fluid property uncertainties.
In the case of transient mode tests (appliance on/off cycle, defrosting cycles, etc.), no maximum measurement uncertainty is required for the heating capacity determined, the absorbed electrical power and the gas heat input. However, the various instruments suitable for determining these parameters should observe the measurement uncertainties defined in Table 5 when used for stabilised mode tests.

6. TEST PROCEDURE

6.1. General

For measurements made in heating mode, set to the highest set-point temperature on the appliance/test device.
For open compressor appliances, the motor should be provided or specified by the manufacturer. The compressor should operate at the running speed specified by the manufacturer.
For all components controlled by means of an inverter type control system (e.g. fan), if the manufacturer gives instructions for setting the frequency for each performance condition, the setting(s) should be applied.

6.2. All appliances

The test conditions are given in the rules for the NF mark.
If a heat transfer fluid other than water is used, the specific heat and density of the heat transfer fluid should be determined and included in the evaluation.

6.3. Ductless appliances

For ductless appliances, adjustments such as the shutters and fan speed should be set to obtain the maximum flow rate.

6.4. Appliances connected to the inside heat exchanger

The volume flow rate and the pressure differential should be determined with reference to normal air (20°C, 101.325kPa having a density of 1.204kg/m³) with a dry heat exchanger.

If the air flow rate is given by the manufacturer without atmospheric pressure or temperature and humidity conditions, it should be considered as that given for normal air conditions.

The air flow rate evaluated by the manufacturer should be converted to normal air conditions. The air flow rate setting should be performed with only the fan in operation.

The air flow rate given by the manufacturer, at the ventilation speed provided, should be set to the resulting external static pressure (ESP) measured.

If the ESP is less than the minimum value given in Table 6, the air flow rate is reduced to this minimum value.

If the ESP is greater than double the minimum value given in Table 6, the air flow rate is increased to double this minimum value.

If the ESP is greater than the minimum value given in Table 6 but not greater than double the minimum value, the ESP is retained.

The apparatus used to set the ESP should be kept in the same position during all the tests.

Nominal powers kW	**Minimum external static power** a b Pa
$0 < Q < 8$	25
$8 \leq Q < 12$	37
$12 \leq Q < 20$	50
$20 \leq Q < 30$	62
$30 \leq Q < 45$	75
$45 \leq Q < 82$	100
$82 \leq Q < 117$	125
$117 \leq Q < 147$	150
$Q \geq 147$	175
a For appliances tested with no air filter, the minimum external static pressure should be increased by 10 Pa. b If the manufacturer's set-up instructions specify that the maximum permissible discharge duct length is less than 1 m, the appliance can be considered to have a free discharge and tested as for a ductless indoor appliance with an ESP of 0Pa.	

Table 6 - Pressure requirements for air conditioners and comfort heat pumps

Note: It should be noted that an air conditioner (or heat pump) is an appliance designed to meet the comfort requirements of the occupants of an air-conditioned (or heated) room.

6.5. Appliances connected to the outdoor heat exchanger

The volume flow rate and the pressure differential should be determined with reference to normal air (20°C, 101.325kPa having a density of 1.204kg/m³) with a dry heat exchanger.

If the air flow rate is given by the manufacturer without atmospheric pressure or temperature and humidity conditions, it should be considered as that given for normal air conditions.

The air flow rate evaluated by the manufacturer should be converted to normal air conditions. The air flow rate setting should be performed with only the fan in operation.

The air flow rate given by the manufacturer at the ventilation speed provided should be set to the resulting external static pressure (ESP) measured.

If the ESP is less than 30 Pa, the air flow rate is reduced to this minimum value.

The apparatus used to set the ESP should be kept in the same position during all the tests.

If the manufacturer's set-up instructions specify that the maximum permissible discharge duct length is less than 1 m, the appliance can be considered to have a free discharge and tested as for a ductless outdoor appliance with an ESP of 0Pa.

6.6. Heating capacity measurement for liquid/liquid and liquid/air appliances

6.6.1. Stabilised mode conditions and setting

The mode is deemed to be stabilised and maintained when all the quantities measured remain constant without having to modify the set-point values for at least 1 hour, in line with the tolerances specified in Table 7. Periodical fluctuations of the quantities measured caused by the use of regulation and control equipment are allowed, provided that the mean or individual value of these fluctuations, according to the circumstances, does not exceed the permissible deviations given in Table 7.

Quantity measured	Permissible deviations on arithmetic mean value with respect to set-point values	Permissible deviations on individual values measured with respect to the set-point value (engine-driven) or arithmetic mean (absorption)
Liquid		
inlet temperature	± 0.2 K	± 0.5 K
outlet temperature	± 0.3 K	± 0.6 K
mean temperature	± 0.2 K	± 0.5 K
volume flow rate	± 2 %	± 5 %
static pressure differential	--	± 10 %
Air		
inlet temperature (dry/wet bulb)	± 0.3 K	± 1 K
volume flow rate	± 5 %	± 10 %
static pressure differential	-	± 10 %
Voltage	± 4 %	± 4 %

Table 7 – Permissible deviations

Depending on the test conditions specified in the standard, there are two possible test condition settings:

Scenario no. 1: Manufacturer water flow rate setting and mean water temperature setting: The test laboratory sets the water flow rate to the manufacturer's nominal flow rate value. The water inlet temperature is then adjusted to obtain the required mean temperature.

Scenario no. 2: Water inlet and outlet temperature setting: The test laboratory sets the water inlet temperature to the value specified in the standard. The water flow rate is then adjusted to obtain the water outlet temperature defined in the standard.

For glycol water tests, the tests should be conducted with 30% MPG (MonoPropylene Glycol).

6.6.2. Heating capacity, cooling capacity, recovery capacity, gas heat input and absorbed electrical power measurement

To measure the capacity and gas heat input values, all the significant data should be recorded continuously. For recorders running in cyclic mode, the sequence should be set to conduct a full recording at least every 30 s.
The capacity and gas heat input values should be measured under stabilised mode conditions. The data acquisition period is 40 min.
All the measurements should be made with the same sampling frequency, over the same data acquisition period.

6.6.3. GUE calculation

The data acquisition period is divided into four 10 min periods. One GUE value is calculated for each period. The fluctuations of the four GUE values should not exceed a 1.5% standard deviation and these individual variations should not exceed 3%.

6.7. Heating capacity measurement for air/air appliances using the enthalpy method and air/liquid appliances

6.7.1. General

The test procedure includes three periods: a warm-up period, a stabilisation period and a data acquisition period. The data acquisition time varies depending on whether the heat pump is running in stabilised or transient mode.
Annexe C provides a flow chart of the procedure and a graphic representation of most of the various possible test sequences for conducting a heating capacity test.

6.7.2. Warm-up period

The test room warm-up apparatus and the heat pump under test should run until the the test tolerances specified in Table 7 are maintained for at least 10 min.

A warm-up period may end with a defrosting cycle. If a warm-up period ends with a defrosting cycle, the heat pump should run in heating mode for at least 10 min after the end of defrosting before starting the stabilisation period.

6.7.3. Stabilisation period

The stabilisation period immediately follows the warm-up period or the defrosting cycle and the 10 min recovery period after the warm-up period.

A full stabilisation period lasts for one hour.

Other than in the case of the specifications in 6.7.7, the heat pump should operate in accordance with the test tolerances specified in Table 7.

6.7.4. Data acquisition period

The data acquisition period immediately follows the stabilisation period.

Data should be recorded at regular intervals of 30 s or less, except during the defrosting cycles as specified below.

During defrosting cycles, and for the 10 min following defrosting, some data used to evaluate the capacity and gas heat input values of the heat pump should be recorded more frequently, at intervals equal to 10 s or less. If the enthalpy method for indoor air is used, these data to be recorded more frequently include the inside dry bulb temperature variation.

For heat pumps that automatically shut down the indoor fan during defrosting, a zero value should be assigned to the heating capacity portion measured during the defrosting phases and/or the inside dry bulb temperature variation when the indoor fan is shut down, if the enthalpy method for indoor air is used. If the calorimetric method is used, integration of the capacity should be continued when the indoor fan is shut down.

The difference between the heat transfer fluid temperatures at the indoor heat exchanger inlet and outlet should be measured. For each 5 min interval during the data acquisition period, a mean temperature differential, ΔT_i (τ), should be calculated. The mean temperature differential for the first 5 minutes of the data acquisition period, ΔT_i ($\tau = 0$), should be recorded to enable the following percent variation calculation:

$$\%\Delta T = \left[\frac{\Delta T_i(\tau = 0) - \Delta T_i(\tau)}{\Delta T_i(\tau = 0)} \right]$$

6.7.5. Test procedure: if the warm-up period ends with a defrosting cycle

If the quantity $\%\Delta T$ exceeds 2.5% in the first 70 minutes of the data acquisition period, the heating capacity test should be considered as a transient mode test (see 6.7.7). If the heat pump starts a defrosting cycle during the stabilisation period or during the first 70 minutes of the data acquisition period, the heating capacity test should be considered as a transient mode test.

If the above conditions are not met and the test tolerances specified in Table 7 are complied with both during the stabilisation period and the first 70 minutes of the data acquisition period, the heating capacity test should be considered as a stabilised mode test. Stabilised mode tests should end after 70 min of data acquisition.

6.7.6. Test procedure: if the warm-up period does not end with a defrosting cycle

6.7.6.1 If the heat pump starts a defrosting cycle during the stabilisation period or during the first 70 minutes of the data acquisition period, the heating capacity test should be restarted in accordance with 6.7.6.3.

6.7.6.2 If the quantity $\%\Delta T$ exceeds 2.5% at any time during the first 70 minutes of the data acquisition period, the heating capacity test procedure should be restarted in accordance with 6.7.6.3. A defrosting cycle should be carried out before restarting the test. This defrosting cycle may be started manually or delayed until the heat pump starts automatic defrosting.

6.7.6.3 If 6.7.6.1 or 6.7.6.2 applies, the restart should take place 10 min after the end of the defrosting cycle with a further stabilisation period of one hour. This second attempt should comply with the requirements in 6.7.3 and 6.7.4and the test procedure in 0.

6.7.6.4 If the conditions specified in 6.7.6.1 or 6.7.6.2 are not met and the test tolerances specified in Table 7 are complied with both during the stabilisation period and the first 70 minutes of the data acquisition period, the heating capacity test should be considered as a stabilised mode test. Stabilised mode tests should end after 70 min of data acquisition.

6.7.7. Transient mode test procedure

If a heating capacity test is considered to be a transient mode test in accordance with 0, the following modifications should be made.

To obtain a valid heating capacity test in transient mode, the test tolerances specified in Table 8 should be obtained both during the stabilisation period and during the data acquisition period. As specified in Table 8, the test tolerances are specified for two subintervals. The interval H consists of the data compiled during each heating phase, except for the first 10 minutes following the end of defrosting. The interval D consists of the data compiled during each defrosting cycle and during the first 10 minutes of the next heating phase.

The test tolerance parameters in Table 8 should be determined throughout the stabilisation and data acquisition periods. All the data compiled during each interval, H or D, should be used to evaluate compliance with the test tolerances in Table 8. The data from two or more H intervals or two or more D intervals should not be combined and subsequently used to evaluate compliance with Table 8. Compliance is based on the evaluation of the data from each individual interval.

The data acquisition period should be extended until 3 hours have elapsed or until the heat pump has completed three full cycles during this period, whichever comes first. If the heat pump is in the process of conducting a defrosting cycle at the end of the 3 hours, the data acquisition period ends at the end of the defrosting cycle. A full cycle consists of a heating period and a defrosting period; from the end of one defrosting to the end of defrosting.

Quantities	Arithmetic mean variations of values with respect to specified test conditions		Individual value variations with respect to the set-point value (engine-driven) or arithmetic mean (absorption)	
	Interval H [a]	Interval D [b]	Interval H [a]	Interval D [b]
Inside air inlet temperature; - dry bulb - wet bulb	 ± 0.6 K -	 ± 1.5 K -	 ± 1.0 K -	 ± 5.0 K -
Outside air inlet temperature; - dry bulb[c] - wet bulb	 ± 0.6 K ± 0.3 K	 ± 1.5 K ± 1.0 K	 ± 1.0 K ± 0.6 K	 ± 5.0 K -
Water inlet temperature	± 0.2 K	-	± 0.5 K	[e]
Water outlet temperature	± 0.5 K	-	± 1.0 K	[d]
Mean water temperature	± 0.5 K	-	-	
Water flow rate	± 2%	/	5%	/
Electricity - Voltage	± 4%		± 4%	

[a] Applicable when the heat pump is in heating mode, except for the first 10 minutes after the end of a defrosting cycle

[b] Applicable during a defrosting cycle and for the first 10 minutes after the end of a defrosting cycle when the heat pump is running in heating mode

[c] For appliances with outdoor heat exchange surface areas greater than 5m², the deviation on the air inlet dry bulb temperature is multiplied by two.

[d] The variation should not exceed +2.0K

[e] The variation should not exceed -5.0K

Table 8 – Permitted variations in heating capacity tests when the transient mode test procedure is used

6.7.8. GUE calculation

The GUE is calculated for the same data acquisition period as the heating and recovery capacities and the absorbed electrical powers, as defined in 6.7.4.

6.8. Heating capacity measurement for air/air appliances using the room calorimeter method

6.8.1. General

The test procedure includes two periods: a stabilisation period and a data acquisition period. The data acquisition time varies depending on whether the heat pump is running in stabilised or transient mode.

6.8.2. Stabilisation period

The test room warm-up apparatus and the heat pump under test should run until the the test tolerances specified in Table 7 are maintained for at least 1 hour, unless defrosting takes place during this period, the tolerances specified in Table 8 apply.
If defrosting takes place during the stabilisation period, the test procedure described in 6.8.5 applies.

6.8.3. Data acquisition period

Data should be recorded at regular intervals of 30 s or less, except during the defrosting cycles as specified below.
The measurement period should not be less than 70 min.
The difference between the heat transfer fluid temperatures at the indoor heat exchanger inlet and outlet should be measured. For each 5 min interval during the data acquisition period, a mean temperature differential, ΔT_i (τ), should be calculated. The mean temperature differential for the first 5 minutes of the data acquisition period, ΔT_i ($\tau = 0$), should be recorded to enable the following percent variation calculation:

$$\%\Delta T = \left[\frac{\Delta T_i(\tau = 0) - \Delta T_i(\tau)}{\Delta T_i(\tau = 0)} \right] \times 100$$

6.8.4. General test procedure:

If defrosting takes place before starting the data acquisition period, or if the quantity $\%\Delta T$ exceeds 2.5% during the data acquisition period, the heating capacity test should be considered as a transient mode test (see 6.8.5). Furthermore, if the heat pump starts a defrosting cycle during the stabilisation period or during the data acquisition period, the heating capacity test should be considered as a transient mode test.

If the above conditions are not met and the test tolerances specified in Table 7 are complied with both during the stabilisation period and the data acquisition period, the heating capacity test should be considered as a stabilised mode test. Stabilised mode tests should end after a data acquisition period of at least 70 min.

6.8.5. Transient mode test procedure

If a heating capacity test is considered to be a transient mode test in accordance with 6.8.4, the following modifications should be made.

To obtain a valid heating capacity test in transient mode, the test tolerances specified in Table 8 should be obtained both during the stabilisation period and during the data acquisition period. As specified in Table 8, these test tolerances are specified for two subintervals. The interval H consists of the data compiled during each heating phase, except for the first 10 minutes following the end of defrosting. The interval D consists of the data compiled during each defrosting cycle and during the first 10 minutes of the next heating phase.

All the data compiled during each interval, H or D, should be used to evaluate compliance with Table 8. The data from two or more H intervals or two or more D intervals should not be combined and subsequently used to evaluate compliance with Table 8. Compliance is based on the evaluation of the data from each individual interval.

The data acquisition period should be extended until 3 hours have elapsed or a full number of cycles have been completed, unless the mean time interval for a full cycle is greater than 2 hours, in which case the data acquisition period should only consist of one full cycle or 4 hours, whichever comes first. A full cycle consists of a heating period and a defrosting period, from the end of one defrosting to the end of defrosting. With this procedure, the maximum data acquisition time is 4 hours.

During defrosting cycles, and for the 10 min following defrosting, some data used to evaluate the capacity and heat input values of the heat pump should be recorded more frequently, at intervals equal to 10 s or less. If the room calorimeter method is used, the data to be recorded more frequently include all the measurements required to determine the inside capacity.

For heat pumps that automatically shut down the indoor fan during a defrosting cycle, capacity integration should be continued when the indoor fan is shut down.

6.9. Measurement in cooling mode

Regardless of the type of appliances tested, the following procedure should be applied for tests in cooling mode.

6.9.1. Stabilised mode conditions and setting

The mode is deemed to be stabilised and maintained when all the quantities measured remain constant without having to modify the set-point values for at least 1 hour, in line with the tolerances specified in Table 7. Periodical fluctuations of the quantities measured caused by the use of regulation and control equipment are allowed, provided that the mean or individual value of these fluctuations, according to the circumstances, does not exceed the permissible deviations given in Table 7.

Depending on the test conditions specified in the standard, there are two possible test condition settings:
Scenario no. 1: Manufacturer water flow rate setting and mean water temperature setting: The test laboratory sets the water flow rate to the manufacturer's nominal flow rate value. The water inlet temperature is then adjusted to obtain the required mean temperature.
Scenario no. 2: Water inlet and outlet temperature setting: The test laboratory sets the water inlet temperature to the value specified in the standard. The water flow rate is then adjusted to obtain the water outlet temperature defined in the standard.

For glycol water tests, the tests should be conducted with 30% MPG (MonoPropylene Glycol).

6.9.2. Cooling capacity, gas heat input and absorbed electrical power measurement in cooling mode

To measure the capacity and gas heat input values, all the significant data should be recorded continuously. For recorders running in cyclic mode, the sequence should be set to conduct a full recording at least every 30 s.
The capacity and gas heat input values should be measured under stabilised mode conditions. The data acquisition period is 40 min.
All the measurements should be made with the same sampling frequency, over the same data acquisition period.

6.9.3. GUE calculation in cooling mode

The data acquisition period is divided into four 10 min periods. One GUE value is calculated for each period. The fluctuations of the four GUE values should not exceed a 1.5% standard deviation and these individual variations should not exceed 3%.

7. Test results

7.1. Data to be recorded

The data to be recorded for performance tests are specified in Tables 9 to 12. The tables identify the general information required but are not intended to limit the data to be obtained.

These data should be the mean values measured for the data acquisition period, except for the time measurement.

Result quantities measured	Unit
Ambient conditions	
- air dry bulb temperature	°C
- atmospheric pressure	mbar
Gas-related quantities	
- gas flow rate	m^3/h or kg/h
- gas pressure (absolute or relative)	mbar
- gas temperature	°C
- gas net calorific value	MJ/m^3 or MJ/kg
- gas density	kg/m^3 or $kg.m^3/kg.m^3$
or	
Wobbe index	MJ/m^3 or MJ/kg
Electrical quantities	
- voltage	V
- total current	A
- total electric power, P_T	W
- effective electric power, P_E	W
Thermodynamic quantities	
Outdoor heat exchanger	
Air	
- inlet dry bulb temperature	°C
- inlet wet bulb temperature	°C
For ducted appliances	
- outlet dry bulb temperature	°C
- outlet wet bulb temperature	°C
- external/internal static pressure differential	Pa
- volume flow rate	m3/s
- condensate flow rate	kg/s
Water or glycol water	
- inlet temperature	°C
- outlet temperature	°C
- volume flow rate	m^3/s or kg/s
- circulation pump speed setting, if applicable	
- pressure differential	kPa

Table 9 – Data to be recorded for tests using the enthalpy method (1/2)

Result quantities measured	Unit
Indoor heat exchanger	
Air	
- inlet dry bulb temperature	°C
- inlet wet bulb temperature	°C
For ducted appliances	
- outlet dry bulb temperature	°C
- outlet wet bulb temperature	°C
- external/internal static pressure differential	Pa
- volume flow rate	m3/s
- condensate flow rate	kg/s
Water or glycol water	
- inlet temperature	°C
- outlet temperature	°C
- volume flow rate or mass flow rate	m^3/s or kg/s
- circulation pump speed setting, if applicable	
- pressure differential	kPa
Heat recovery exchanger	
- inlet temperature	
- outlet temperature	°C
- volume flow rate	°C
- circulation pump speed setting, if applicable	m^3/s or kg/s
- pressure differential	
	kPa
Heat transfer fluid (other than water)	
- concentration (volume)	%
- density	kg/m^3
- specific heat	J/kg.K
Defrosting	
- defrosting period	s
- operating cycle with defrosting	s
Data acquisition period	s
Capacities	
- heating capacity (P_H)	W
- effective heating capacity (Q_{Eh})	W

- cooling capacity (P_F)	W
- effective cooling capacity (Q_{EF})	W
- heat recovery capacity (P_{EHR})	W
- effective heat recovery capacity (Q_{EHR})	W
Coefficients	
- GUE_h	W/W
- GUE_F	W/W
- SHR[a]	W/W
[a] For air/air appliances only	

Table 10 – Data to be recorded for tests using the enthalpy method (2/2)

Result quantity measured	Unit
Ambient conditions	
atmospheric pressure	kPa
Electrical quantities	
voltage	V
total current	A
total absorbed power, P_T	W
effective absorbed power, P_E	W
Thermodynamic quantities	
Indoor heat exchanger	
Air	
inlet dry bulb temperature	°C
inlet wet bulb temperature	°C
For ducted appliances	
outlet dry bulb temperature	°C
outlet wet bulb temperature	°C
external/internal static pressure differential	Pa
volume flow rate, q	m^3/s
condensate flow rate	kg/s
Water or glycol water	
inlet temperature	°C
outlet temperature	°C
volume flow rate	m^3/s
circulation pump speed setting, if applicable	-
pressure differential	kPa
Outdoor heat exchanger	
Air	
inlet dry bulb temperature	°C
inlet wet bulb temperature	°C
For ducted appliances	
external/internal static pressure differential	Pa
volume flow rate	m^3/s
Water or glycol water	
inlet temperature	°C
outlet temperature	°C

Result quantity measured	Unit
volume flow rate	m^3/s
circulation pump speed setting, if applicable	-
pressure differential	kPa

Table 11 – Data to be recorded for tests using the calorimetric method (1/3)

Result quantity measured	Unit
inlet wet bulb temperature	°C
For ducted appliances	
outlet dry bulb temperature	°C
outlet wet bulb temperature	°C
external/internal static pressure differential	Pa
volume flow rate, *q*	m^3/s
Water or glycol water	
inlet temperature	°C
outlet temperature	°C
volume flow rate	m^3/s
circulation pump speed setting, if applicable	-
pressure differential	kPa
Heat recovery exchanger	
inlet temperature	°C
outlet temperature	°C
volume flow rate	m^3/s
pressure differential	kPa
Heat transfer fluid (other than water)	
concentration (volume)	%
density	kg/m^3
specific heat	J/kg.K
Liquid refrigerant [a]	
discharge pressure	bar abs.
saturated vapour temperature / bubble point	°C
liquid temperature	°C
Compressor component(s)	
open compressor running speed	min^{-1}
engine power (for open compressors only)	W
component frequency in case of Inverter control	Hz

Table 12 – Data to be recorded for tests using the calorimetric method (2/3)

Result quantity measured	Unit
ambient temperature around room calorimeter	°C
Room calorimeter	
power supplied to room calorimeter	W
power extracted from room calorimeter	W
ambient temperature around room calorimeter	°C
humidifier incoming water temperature	°C
condensate temperature	°C
Defrosting	
defrosting period	s
operating cycle with defrosting	min
Capacities	
- heating capacity (P_H)	W
- total cooling capacity (P_C)	W
- latent cooling capacity (P_L)	W
- sensitive cooling capacity (P_S)	W
Coefficients	
- COP	W/W
- EER	W/W
- SHR[a]	W/W
[a] For air/air appliances only	

Table 13 – Data to be recorded for tests using the calorimetric method (3/3)

Note: The gas-related quantity measurements (see Table 9) should also be recorded for tests based on the calorimetric method (therefore, in addition to those in Table 11 to Table 13.

ANNEXE A

CALCULATION OF CORRECTIONS C_{INDOOR}, $C_{OUTDOOR}$ AND C_{HR}

A.1 – Calculation of correction c_{indoor}

- For appliances using air as the inside heat transfer fluid:

If the fan is built into the appliance:

$$c_{indoor} = \frac{q \times (\Delta p_e - ESP_{\min})}{\eta} \qquad \text{(A.1)}$$

else

$$c_{indoor} = \frac{q \times (\Delta pi + ESP_{\min})}{\eta} \qquad \text{(A.2)}$$

where

η is 0.3 by convention;

(Δp_e–$ESP_{\min}$) is the available external static pressure differential measured on the appliance terminals – the minimum external static pressure as defined in Table 6, expressed in Pascal;

(Δpi+$ESP_{\min}$) is the available external static pressure differential measured on the appliance terminals + the minimum external static pressure as defined in Table 6, expressed in Pascal;

q is the nominal indoor air flow rate, expressed in cubic metres per second.

- For appliances using a liquid as the inside heat transfer fluid

If the circulation pump is built into the appliance:

$$c_{indoor} = \frac{q \times \Delta p_e}{\eta} \qquad \text{(A.3)}$$

else

$$c_{indoor} = \frac{q \times \Delta pi}{\eta} \qquad \text{(A.4)}$$

where

η is determined using the method in Appendix B;

Δp_e is the available external static pressure differential measured, expressed in Pascal;

Δp_i is the internal static pressure differential, expressed in Pascal;

q is the nominal water flow rate, expressed in cubic metres per second.

A.2 – Calculation of correction $c_{outdoor}$

- For appliances using air as the outside heat transfer fluid

If the fan is built into the appliance:

$$c_{outdoor} = \frac{q \times (\Delta p_e - ESP_{\min})}{\eta} \quad \text{(A.1)}$$

else

$$c_{outdoor} = \frac{q \times (\Delta pi + ESP_{\min})}{\eta} \quad \text{(A.2)}$$

where

η is 0.3 by convention;

(Δp_e–$ESP_{\min}$) is the available external static pressure differential measured on the appliance terminals – the minimum external static pressure as defined in Table 6, expressed in Pascal;

(Δpi+$ESP_{\min}$) is the available external static pressure differential measured on the appliance terminals + the minimum external static pressure as defined in Table 6, expressed in Pascal;

q is the nominal indoor air flow rate, expressed in cubic metres per second.

- For appliances using a liquid as the outside heat transfer fluid

If the circulation pump is built into the appliance:

$$c_{outdoor} = \frac{q \times \Delta p_e}{\eta} \quad \text{(A.7)}$$

else

$$c_{outdoor} = \frac{q \times \Delta pi}{\eta} \quad \text{(A.8)}$$

where

η is determined using the method in Appendix B;

Δp_e is the available external static pressure differential measured, expressed in Pascal;

Δp_i is the internal static pressure differential, expressed in Pascal;

q is the nominal water flow rate, expressed in cubic metres per second.

A.3 – Calculation of correction c_{hr}

Heat recovery is only carried out on a liquid circuit.

If the circulation pump is built into the appliance:

$$c_{hr} = \frac{q \times \Delta p_e}{\eta} \quad \text{(A.9)}$$

else

$$c_{hr} = \frac{q \times (-\Delta pi)}{\eta} \quad \text{(A.10)}$$

where

- η is determined using the method in Appendix B;
- Δp_e is the available external static pressure differential measured, expressed in Pascal;
- Δp_i is the internal static pressure differential, expressed in Pascal;
- q is the nominal water flow rate, expressed in cubic metres per second.

ANNEXE B
LIQUID CIRCULATION PUMP EFFICIENCY DETERMINATION

B.1 General

The circulation pump efficiency calculation method, regardless of whether the pump is built into the appliance, is based on the relationship between the efficiency of the pump and its hydraulic power.

B.2 Liquid circulation pump hydraulic power

The circulation pump is built into the appliance

If the circulation pump is built into the appliance, the hydraulic power of the pump is defined as follows:

$$P_{hydrau} = q * \Delta pe \qquad \text{(B.1)}$$

where

P_{hydrau} is the hydraulic power of the pump, in Watts;

q is the water volume flow rate, in m³/s;

Δp_e is the available external static pressure differential measured, in Pascal.

The circulation pump is not built into the appliance

If the circulation pump is not built into the appliance, the hydraulic power of the pump is defined as follows:

$$P_{hydrau} = q * (-\Delta pi) \qquad \text{(B.2)}$$

where

P_{hydrau} is the hydraulic power of the pump, in Watts;

Q is the water volume flow rate, in m³/s;

Δp_i is the available internal static pressure differential measured, in Pascal.

Circulation pump efficiency

The liquid circulation pump efficiency required to output the hydraulic power is determined using the following formula:

a) If the measured hydraulic power of the circulation pump is less than 500W, the pump efficiency is determined using the following equation:

$$\eta = 0.0721 P_{hydrau}^{\ 0.3183} \qquad \text{(B.3)}$$

b) If the measured hydraulic power of the circulation pump is greater than 500W, the pump efficiency is determined using the following equation:

$$\eta = 0.092 Ln(P_{hydrau}) - 0.0403 \qquad \text{(B.4)}$$

where

η is the liquid circulation pump efficiency;

P_{hydrau} is the measured hydraulic power of the pump, in Watts.

The pump efficiency graphs as a function of the hydraulic power are given below as an indication.

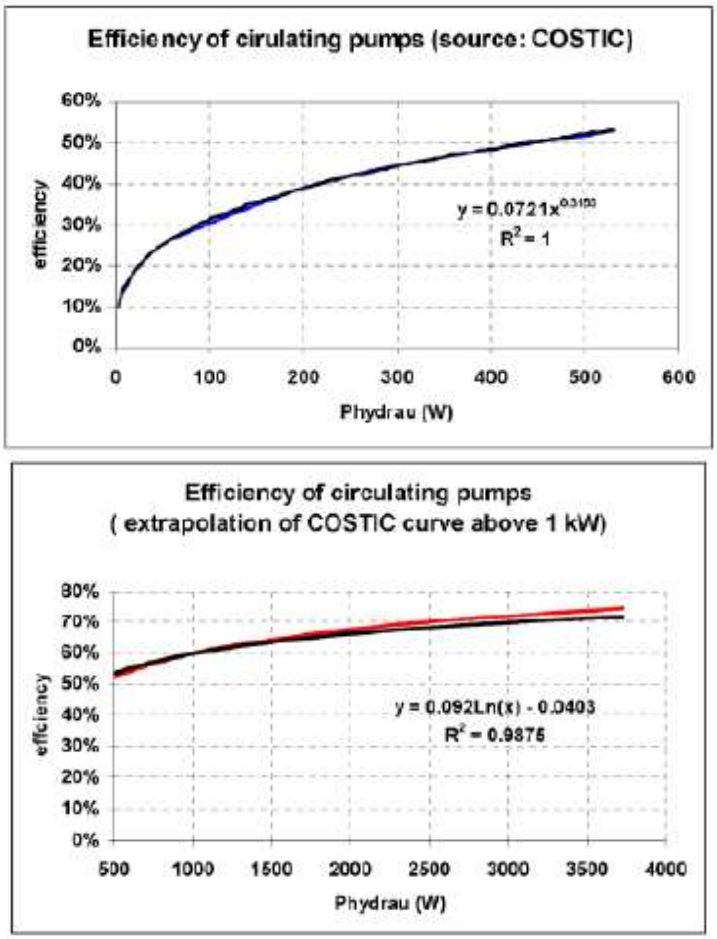

Figure B.1— Pump efficiency as a function of hydraulic power

ANNEXE C

HEATING CAPACITY TESTS — FLOW CHART AND EXAMPLES OF VARIOUS TEST SEQUENCES

C.1 Figure E.1 illustrates, using a flow chart, the test procedure described in 6.6.2.

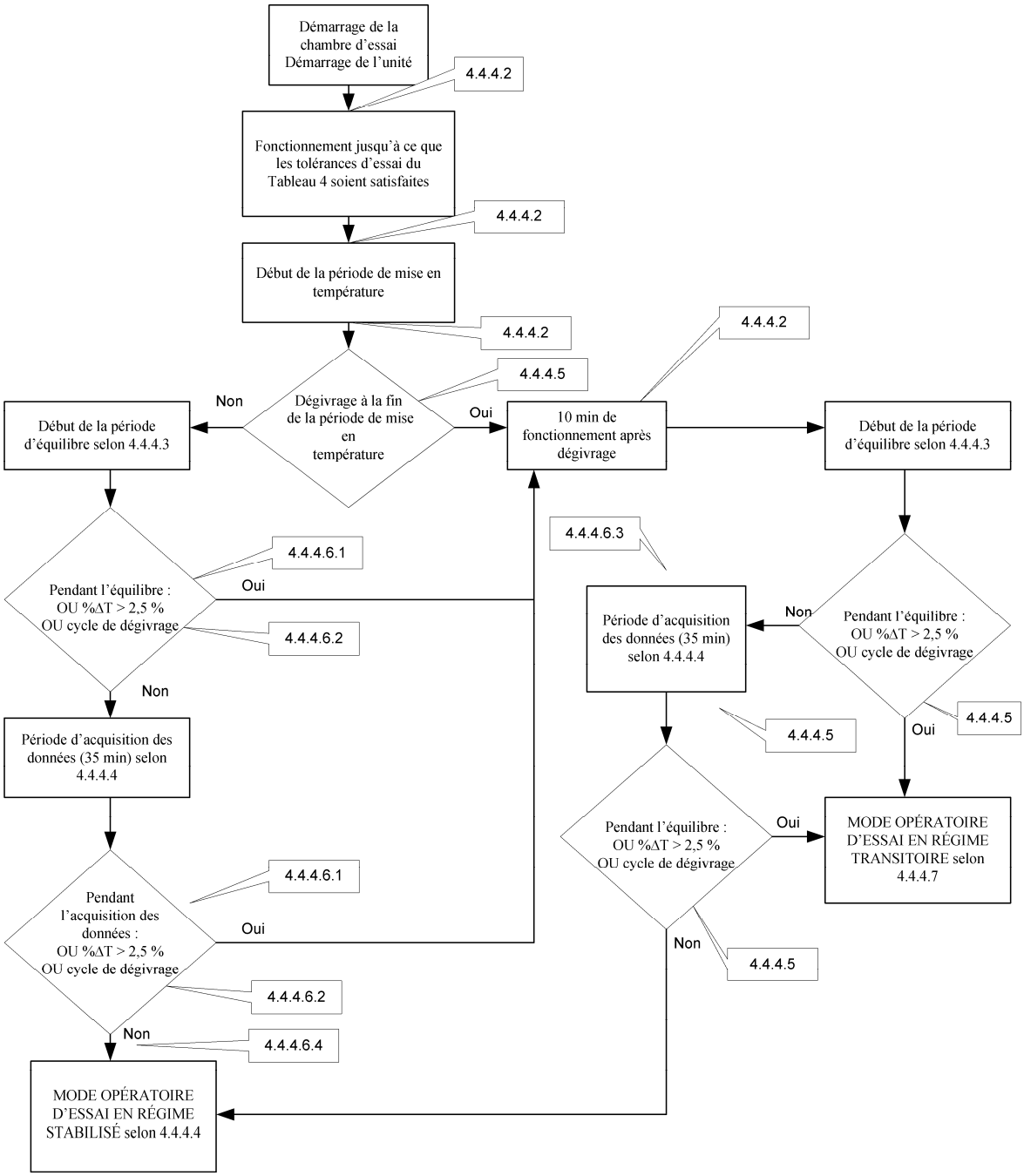

Figure C.1 — Flow chart

C.2 Figures E.2 to E.7 below show some scenarios liable to arise during a heating capacity test as specified in 6.6.2. All the examples show scenarios in which a warm-up period ends with a defrosting cycle.

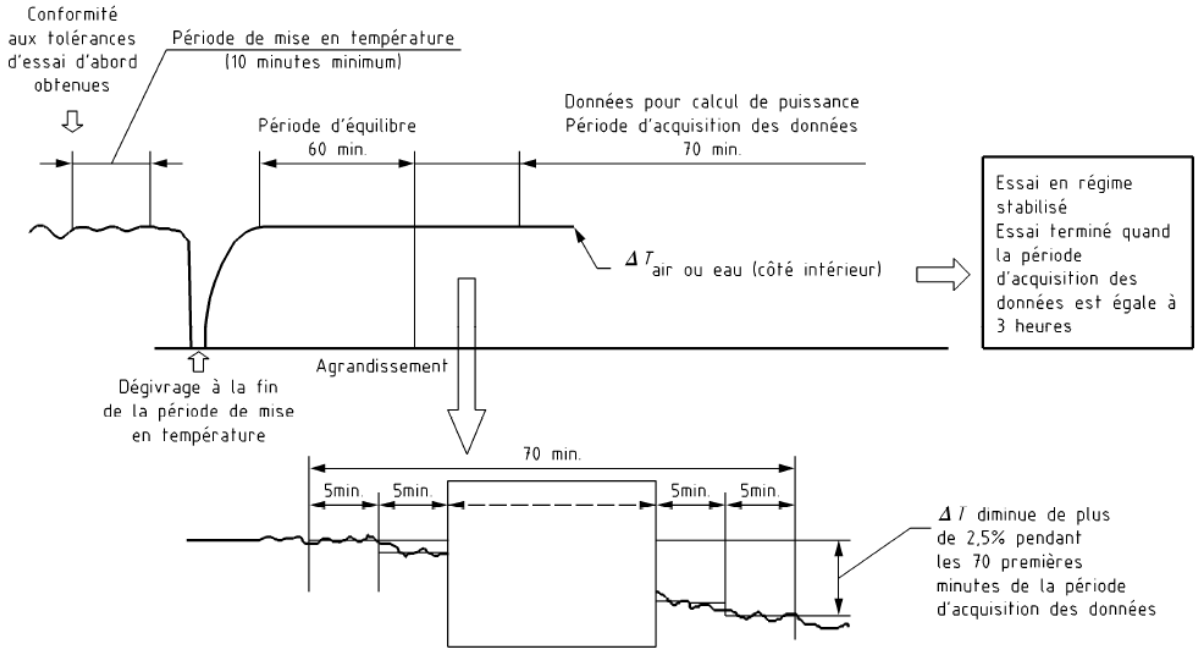

Figure Erreur ! Code op. conditionnel inconnu.2 — Stabilised mode heating capacity test

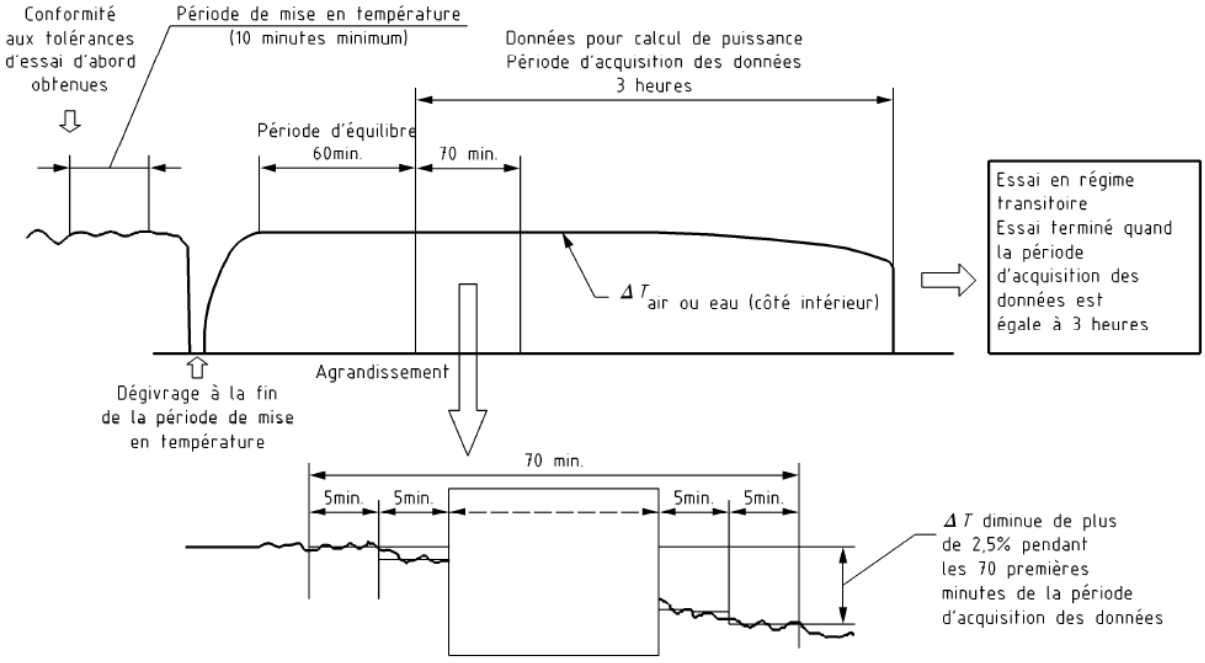

Figure Erreur ! Code op. conditionnel inconnu.**3 — Transient mode heating capacity test without defrosting cycle**

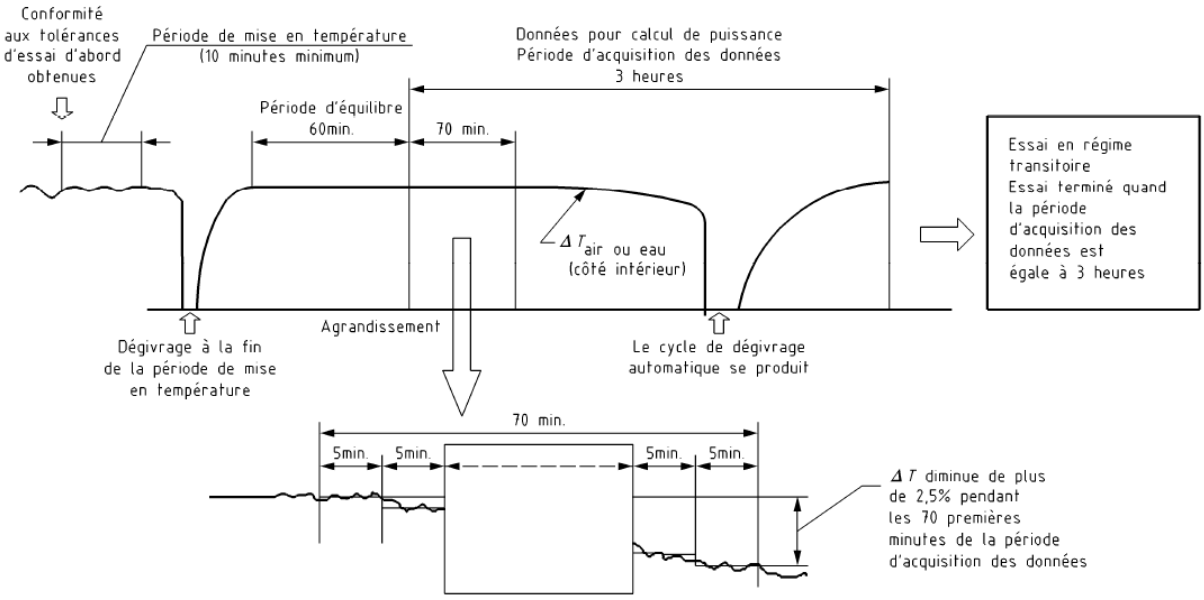

Figure Erreur ! Code op. conditionnel inconnu.**4 — Transient mode heating capacity test with defrosting cycle during data acquisition period**

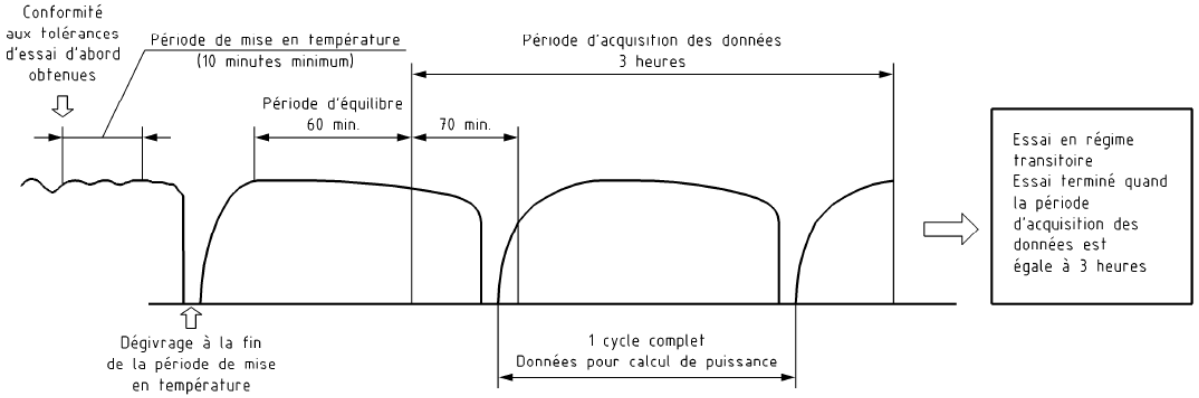

Figure C.5 — Transient mode heating capacity test with full cycle during data acquisition period

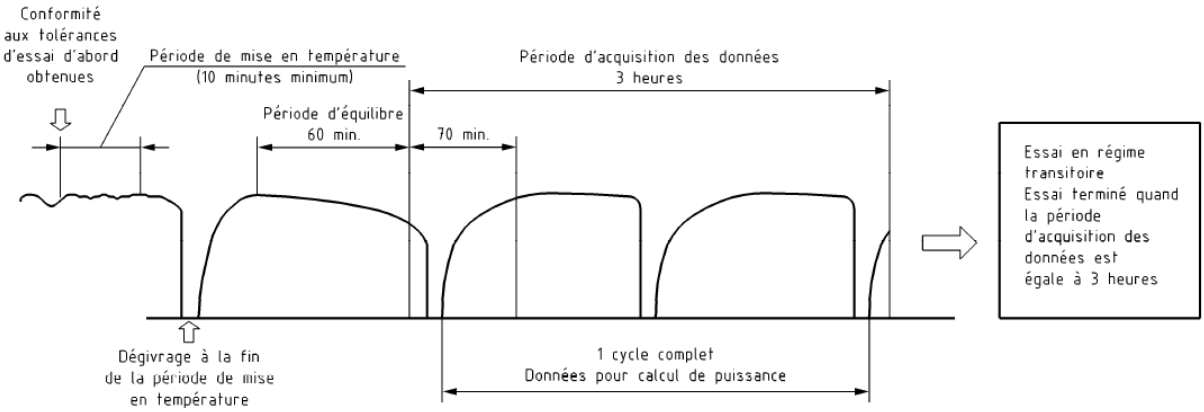

Figure Erreur ! Code op. conditionnel inconnu.**6 — Transient mode heating capacity tests with two full cycles during data acquisition period**

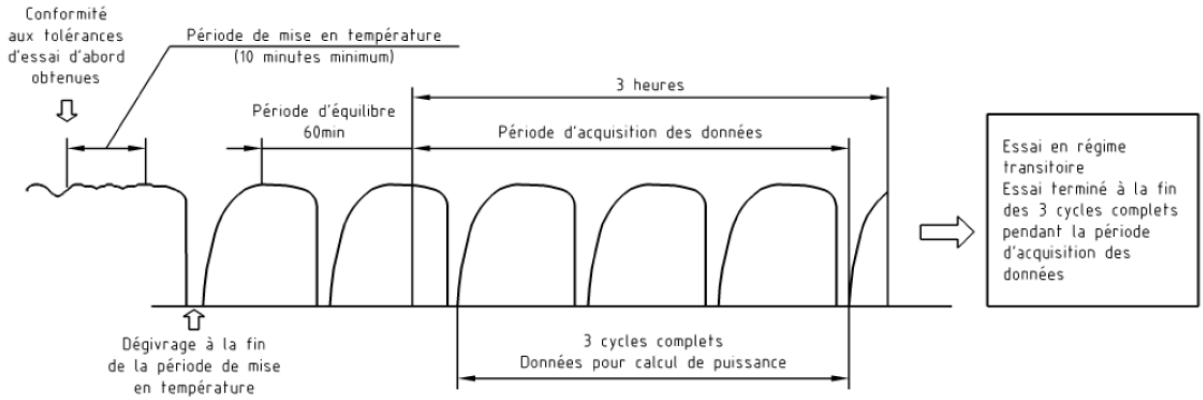

Figure Erreur ! Code op. conditionnel inconnu.**7 — Transient mode heating capacity test with three full cycles during data acquisition period**